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DABOLL'S

SCHOOLMASTER'S ASSISTANT:

IMPROVED AND ENLARGED.

BEING A PLAIN

PRACTICAL SYSTEM

OF

ARITHMETIC:

ADAPTED TO THE UNITED STATES.

STEREOTYPE EDITION.

BY NATHAN DABOLL.

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DISTRICT OF CONNECTICUT, ss.

L. S. BE IT REMEMBERED, That on the twenty-first day of October, in the thirty-sixth year of the Independence of the United States of America, SAMUEL GREEN, of said District, hath deposited in this office the title of a Book, the right whereof he claims as Proprietor, in the words following, *to wit* :—"Daboll's Schoolmaster's Assistant: improved and enlarged. Being a plain practical system of Arithmetic: adapted to the United States. Stereotype Edition. By NATHAN DABOLL."

In conformity to the Act of the Congress of the United States, entitled, "An Act for the encouragement of learning, by securing the copies of Maps, Charts and Books, to the Authors and proprietors of them during the times therein mentioned."

HENRY W. EDWARDS,
Clerk of the District of Connecticut.

A true copy of Record. Examined and sealed by me,
H. W. EDWARDS, *Clerk of the Dist. of Conn.*

RECOMMENDATIONS.

YALE-COLLEGE, NOV. 27, 1799.

I HAVE read DABOLL'S SCHOOLMASTER'S ASSISTANT. The arrangement of the different branches of Arithmetic is judicious and perspicuous. The author has well explained Decimal Arithmetic, and has applied it in a plain and elegant manner in the solution of various questions, and especially to those relative to the Federal Computation of money. I think it will be a very useful book to Schoolmasters and their pupils.

JOSIAH MEIGS, *Professor of Mathematics and Natural Philosophy.*

[Since Surveyor-General of the United States.]

I HAVE given some attention to the work above mentioned, and concur with Mr. Professor Meigs in his opinion of its merit. NOAH WEBSTER.

New-Haven, December 12, 1799.

RHODE-ISLAND COLLEGE, NOV. 30, 1799.

I HAVE run through Mr. DABOLL'S SCHOOLMASTER'S ASSISTANT, and have formed of it a very favorable opinion. According to its original design, I think it well "calculated to furnish Schools in general with a methodical, easy and comprehensive System of Practical Arithmetic." I therefore hope it may find a generous patronage, and have an extensive spread.

ASA MESSER, *Professor of the Learned Languages, and Teacher of Mathematics.*

[President of that Institution.]

RECOMMENDATIONS.

PLAINFIELD ACADEMY, APRIL 20, 1802.

I MAKE use of DABOLL's SCHOOLMASTER's ASSISTANT, in teaching common Arithmetic, and think it the best calculated for that purpose of any which has fallen within my observation. JOHN ADAMS, *Rector of Plainfield Academy.*

[Now Principal of Phillips' Academy, Andover, Mass.]

BILLERICA ACADEMY, (MASS.) DEC. 10, 1807.

HAVING examined Mr. DABOLL's System of Arithmetic, I am pleased with the judgment displayed in his method, and the perspicuity of his explanations, and thinking it as easy and comprehensive a system as any with which I am acquainted, can cheerfully recommend it to the patronage of Instructors.

SAMUEL WHITING,
Teacher of Mathematics.

FROM MR. KENNEDY, TEACHER OF MATHEMATICS.

I BECAME acquainted with DABOLL's SCHOOLMASTER's ASSISTANT, in the year 1802, and on examining it attentively, gave it my decided preference to any other system extant, and immediately adopted it for the pupils under my charge; and since that time have used it exclusively in elementary tuition, to the great advantage and improvement of the student, as well as the ease and assistance of the Preceptor. I also deem it equally well calculated for the benefit of individuals in private instruction; and think it my duty to give the labour and ingenuity of the author the tribute of my hearty approval and recommendation.

ROGER KENNEDY.

New-York, March 20, 1811.

PREFACE.

THE design of this work is to furnish the schools of the United States with a methodical and comprehensive system of *Practical Arithmetic*, in which I have endeavoured, through the whole, to have the rules as concise and familiar, as the nature of the subject will permit.

During the long period which I have devoted to the instruction of youth in Arithmetic, I have made use of various systems which have just claims to scientific merit; but the authors appear to have been deficient in an important point—the practical teacher's experience.—They have been too sparing of examples, especially in the first rudiments; in consequence of which, the young pupil is hurried through the ground rules too fast for his capacity. This objection I have endeavoured to obviate in the following treatise.

In teaching the first rules, I have found it best to encourage the attention of scholars by a variety of easy and familiar questions, which might serve to strengthen their minds as their studies grow more arduous.

The rules are arranged in such order as to introduce the most simple and necessary parts, previous to those which are more abstruse and difficult.

To enter into a detail of the whole work would be tedious; I shall therefore notice only a few particulars, and refer the reader to the contents.

Although the Federal Coin is purely decimal, it is so nearly allied to whole numbers, and so absolutely necessary to be understood by every one, that I have introduced it immediately after addition of whole numbers, and also shown how to find the value of goods therein, immediately after simple multiplication; which may be of great advantage to many, who perhaps will not have an opportunity of learning fractions.

In the arrangement of fractions, I have taken an entire new method, the advantages and facility of which will *sufficiently apologize* for its not being according to other systems. As decimal fractions may be learned much easier than vulgar, and are more simple, useful, and necessary, and soonest wanted in more useful branches of Arithmetic, they ought to be learned first, and Vulgar Fractions omitted, until further progress in the science shall make them necessary. It may be well to obtain a general idea of them, and to attend to two or three easy problems therein: after which, the scholar may learn decimals, which will be necessary in the reduction of currencies, computing interst, and many other branches.

Besides, to obtain a thorough knowledge of Vulgar Fractions, is generally a task too hard for young scholars who have made no further progress in Arithmetic than Reduction, and often discourages them.

I have therefore placed a few problems in Fractions, according to the method above hinted; and after going through the principal mercantile rules, have treated upon Vulgar Fractions at large, the scholar being now capable of going through them with advantage and ease.

In Simple Interest, in Federal Money, I have given several new and concise rules; some of which are particularly designed for the use of the compting-house.

The *Appendix* contains a variety of rules for casting Interest, Rebate, &c. together with a number of the most easy and useful problems, for measuring superficies and solids, examples of forms commonly used in transacting business, useful tables, &c. which are designed as aids in the common business of life.

Perfect accuracy, in a work of this nature, can hardly be expected; errors of the press, or perhaps of the author, may have escaped correction. If any such are pointed out, it will be considered as a mark of friendship and favor, by

The public's most humble
and obedient Servant,
NATHAN DABOLL.

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DABOLL'S

SCHOOLMASTER'S ASSISTANT.

* * *

ARITHMETICAL TABLES.

Numeration Table.

Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
9	8	7	6	5	4	3	2	1
	9	8	7	6	5	4	3	2
		9	8	7	6	5	4	3
			9	8	7	6	5	4
				9	8	7	6	5
					9	8	7	6
						9	8	7
							9	8
								9

Pence Table.

d.		*s.*	*d.*	*d.*		*s.*
20	is	1	8	12	is	1
30		2	6	24		2
40		3	4	36		3
50		4	2	48		4
60		5	0	60		5
70		5	10	72		6
80		6	8	84		7
90		7	6	96		8
100		8	4	108		9
110		9	2	120		10
120		10	0	132		11

	make	
4 farthings	1 penny,	*d*
12 pence,	1 shilling,	
20 shillings,	1 pound,	£.

ADDITION AND SUBTRACTION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	5	6	7	8	9	10	11	12	13	14
3	5	6	7	8	9	10	11	12	13	14	15
4	6	7	8	9	10	11	12	13	14	15	16
5	7	8	9	10	11	12	13	14	15	16	17
6	8	9	10	11	12	13	14	15	16	17	18
7	9	10	11	12	13	14	15	16	17	18	19
8	10	11	12	13	14	15	16	17	18	19	20
9	11	12	13	14	15	16	17	18	19	20	21
10	12	13	14	15	16	17	18	19	20	21	22

MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	[illegible]	[illegible]	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

To learn this Table: Find your multiplier in the left hand column, and the multiplicand a-top, and in the common angle of meeting, or against your multiplier, along at the right hand, and under your multiplicand, you will find the product, or answer.

2. *Troy Weight.*

24 grains (*gr.*) make	1 penny-weight, marked	*pwt.*
20 penny-weights,	1 ounce,	*oz.*
12 ounces,	1 pound,	*lb.*

3. *Avoirdupois Weight.*

16 drams (*dr.*) make	1 ounce,	*oz.*
16 ounces,	1 pound,	*lb.*
28 pounds,	1 quarter of a hundred weight,	*qr.*
4 quarters,	1 hundred weight,	*cwt.*
20 hundred weight,	1 ton,	*T.*

By this weight are weighed all coarse and drossy goods, grocery wares, and all metals except gold and silver.

4. *Apothecaries Weight.*

20 grains (*gr.*) make	1 scruple,	℈
3 scruples,	1 dram,	ʒ
8 drams,	1 ounce,	℥
12 ounces,	1 pound,	℔

Apothecaries use this weight in compounding their medicines.

5. *Cloth Measure.*

4 nails (*na.*) make	1 quarter of a yard,	*qr.*
4 quarters,	1 yard,	*yd.*
3 quarters,	1 Ell Flemish,	*E. Fl.*
5 quarters,	1 Ell English,	*E. E.*
6 quarters,	1 Ell French,	*E. Fr.*

6. *Dry Measure.*

2 pints (*pt.*) make	1 quart,	*qt.*
8 quarts,	1 peck,	*pk.*
4 pecks,	1 bushel,	*bu.*

This measure is applied to grain, beans, flax-seed, salt, oats, *oysters, coal*, &c.

7. *Wine Measure.*

4 gills (*gi.*) make	1 pint,	*pt.*
2 pints,	1 quart,	*qt.*
4 quarts,	1 gallon,	*gal.*
31½ gallons,	1 barrel,	*bl.*
42 gallons,	1 tierce,	*tier.*
63 gallons,	1 hogshead,	*hhd.*
2 hogsheads,	1 pipe,	*p.*
2 pipes,	1 tun,	*T.*

All brandies, spirits, mead, vinegar, oil, &c. are measured by wine measure. *Note.*—231 solid inches, make a gallon.

8. *Long Measure.*

3 barley corns (*b. c.*) make	1 inch, marked	*in.*
12 inches,	1 foot,	*ft.*
3 feet,	1 yard,	*yd.*
5½ yards,	1 rod, pole, or perch,	*rd.*
40 rods,	1 furlong,	*fur.*
8 furlongs,	1 mile,	*m.*
3 miles,	1 league,	*lea.*
69½ statute miles,	1 degree, on the earth.	

360 degrees, the circumference of the earth.

The use of long measure is to measure the distance of places, or any other thing, where length is considered, without regard to breadth.

N. B. In measuring the height of horses, 4 inches make 1 hand. In measuring depths, six feet make 1 fathom, or French toise. Distances are measured by a chain, four rods long, containing one hundred links.

9. *Land, or Square Measure.*

144 square inches make	1 square foot.
9 square feet,	1 square yard.
30¼ square yards, or 272¼ square feet,	1 square rod.
40 square rods,	1 square rood.
4 square roods,	1 square acre.
640 square acres,	1 square mile.

10. *Solid or Cubic Measure.*

1728 solid inches make	1 solid foot.
40 feet of round timber, or 50 feet of hewn timber,	1 ton or load.
128 solid feet or 8 feet long, 4 wide, and 4 high,	1cord of wood.

All solids, or things that have length, breadth and depth, are measured by this measure. N. B. The wine gallon contains 231 solid or cubic inches, and the beer gallon, 282. A bushel contains 2150,42 solid inches.

11. *Time.*

60 seconds (*S.*) make	1 minute, marked	*S. M.*
60 minutes,	1 hour,	*h.*
24 hours,	1 day,	*d.*
7 days,	1 week,	*w.*
4 weeks,	1 month,	*mo.*
13 months, 1 day and 6 hours,	1 Julian year,	*yr.*

Thirty days hath September, April, June, and November, February twenty-eight alone, all the rest have thirty-one.

N. B. In bissextile, or leap year, February hath 29 days.

12. *Circular Motion.*

60 seconds (″) make	1 minute,	′
60 minutes,	1 degree,	°
30 degrees,	1 sign,	*S.*

12 signs, or 360 degrees, the whole great circle of the Zodiac.

Explanation of Characters used in this Book.

$=$ *Equal to*, as 12*d.* $=$ 1*s.* signifies that 12 pence are equal to 1 shilling.

$+$ *More*, the sign of addition, as $5+7=12$, signifies that 5 and 7 added together, are equal to 12.

$-$ *Minus*, or *less*, the sign of subtraction, as $6-2=4$, signifies that 2 subtracted from 6, leaves 4.

$\times$ *Multiply*, or *with*, the sign of Multiplication; as $4\times3=12$, signifies that 4 multiplied by 3, is equal to 12.

$\div$ The sign of Division; as $8\div2=4$, signifies that 8 divided by 2, is equal to 4; or thus, $\frac{8}{2}=4$, each of which signify the same thing.

$: :$ Four points set in the middle of four numbers, denote them to be proportional to one another, by the rule of three; as $2:4::8:16$; that is, as 2 to 4, so is 8 to 16.

$\sqrt{\ }$ Prefixed to any number, supposes that the square root of that number is required.

$\sqrt[3]{\ }$ Prefixed to any number, supposes the cube root of that number is required.

$\sqrt[4]{\ }$ Denotes the biquadrate root, or fourth power, &c.

ARITHMETIC.

ARITHMETIC is the art of computing by numbers, and has five principal rules for its operation, viz. Numeration, Addition, Subtraction, Multiplication, and Division.

NUMERATION.

Numeration is the art of numbering. It teaches to express the value of any proposed number by the following characters, or figures;

1, 2, 3, 4, 5, 6, 7, 8, 9, 0—or cypher.

Besides the simple value of figures, each has a local value, which depends upon the place it stands in, viz. any figure in the place of units, represents only its simple value, or so many ones, but in the second place, or

---

Note.—Although a cypher standing alone signifies nothing; yet when it is placed on the right hand of figures, it increases their value in a tenfold proportion, by throwing them into higher places. Thus 2 with a cypher annexed to it, becomes 20, twenty, and with two cyphers, thus, 200, two hundred.

2. When numbers consisting of many figures, are given to be read, it will be found convenient to divide them into as many periods as we can, of six figures each, reckoning from the right hand towards the left, calling the first the period of units, the second that of millions, the third billions, the fourth trillions, &c. as in the following number:

8 0 7 3, 6 2 5 4 6 2, 7 8 9 0 1 2, 5 0 6 7 9 2,

4. *Period of Trillions.*	3. *Period of Billions.*	2. *Period of Millions.*	1. *Period of Units.*
8073	625462	789012	506792

The foregoing number is read thus—Eight thousand and seventy-three trillions; six hundred and twenty-five thousand, four hundred and sixty-two billions; seven hundred and eighty-nine thousand and twelve millions; five hundred and six thousand, seven hundred and ninety-two.

N. B. Billions is substituted for millions of millions.

Trillions for millions of millions of millions.

Quatrillions for millions of millions of millions of millions, &c.

place of tens, it becomes so many tens, or ten times its simple value, and in the third place, or place of hundreds, it becomes an hundred times its simple value, and so on, as in the following

TABLE:

C. of Millions,	X. of Millions,	Millions,	C. of Thousands,	X. of Thousands,	Thousands,	Hundreds,	Tens,	Units,	
								1	- One.
							2	1	- Twenty-one.
						3	2	1	- Three hundred twenty-one.
					4	3	2	1	- Four thousand 321.
				5	4	3	2	1	- Fifty-four thousand 321.
			6	5	4	3	2	1	- 654 thousand 321.
		7	6	5	4	3	2	1	- 7 million 654 thousand 321.
	8	7	6	5	4	3	2	1	- 87 million 654 thousand 321.
9	8	7	6	5	4	3	2	1	- 987 million 654 thousand 321.
1	2	3	4	5	6	7	8	9	- 123 million 456 thousand 789.
9	8	7	6	5	4	3	4	8	- 987 million 654 thousand 348.

To know the value of any number of figures.

RULE.

1. Numerate from the right to the left hand, each figure in its proper place, by saying, units, tens, hundreds, &c. as in the Numeration Table.

2. To the simple value of each figure, join the name of its place, beginning at the left hand, and reading to the right.

EXAMPLES.

Read the following numbers.

365, Three hundred and sixty-five.
5461, Five thousand four hundred and sixty-one.
1234, One thousand two hundred and thirty-four.
54026, Fifty-four thousand and twenty-six.

123461, One hundred and twenty-three thousand four
hundred and sixty-one.

4666240, Four millions, six hundred and sixty-six thousand two hundred and forty.

NOTE.—For convenience in reading large numbers, they may be divided into periods of three figures each, as follows :

987, Nine hundred and eighty-seven.
987 000, Nine hundred and eighty-seven thousand.
987 000 000, Nine hundred and eighty-seven million.
987 654 321, Nine hundred and eighty-seven million,
six hundred and fifty-four thousand,
three hundred and twenty-one.

To write numbers.

RULE.

Begin on the right hand, write units in the units place, tens in the tens place, hundreds in the hundreds place, and so on, towards the left hand, writing each figure according to its proper value in numeration; taking care to supply those places of the natural order with cyphers which are omitted in the question.

EXAMPLES.

Write down in proper figures the following numbers :
Thirty-six.
Two hundred and seventy-nine.
Thirty-seven thousand, five hundred and fourteen.
Nine millions, seventy-two thousand and two hundred.
Eight hundred millions, forty-four thousand and fifty-five.

SIMPLE ADDITION,

Is putting together several smaller numbers, of the same denomination, into one larger, equal to the whole or sum total; as 4 dollars and six dollars in one sum is 10 dollars.

RULE.

Having placed units under units, tens under tens, &c. draw a line underneath, and begin with the units; after adding up every figure in that column, consider how many tens are contained in their sum; set down the remainder under the units, and carry so many as you have tens, to the next column of tens; proceed in the same manner through every column, or row, and set down the whole amount of the last row.

EXAMPLES.

(1.)

Tens.	Units.
4	2
5	3
5	2
1	3
8	9

(2.)

Hundreds.	Tens.	Units.
4	1	4
2	9	1
8	5	1
1	5	2
6	9	8

(3.)

Thousands.	Hundreds.	Tens.	Units.
1	7	5	6
0	4	3	2
9	4	7	8
1	6	6	6
7	4	2	2

(4.)

C. of Thousands.	X. of Thousands.	Thousands.	Hundreds.	Tens.	Units.
5	5	2	6	2	1
3	4	6	9	7	7
4	1	3	3	3	9
3	2	1	0	1	2
8	7	6	5	4	3

(5.)

3 1 4 8 5
6 7 2 3 7
4 2 7 1 9
9 7 1 4 5
3 2 8 5 1
1 4 5 7 2

(6.)

6 4 1 7 9
2 5 7 1 2
8 4 1 9 4
3 2 5 1 6
7 1 4 3 2
3 2 7 1 9

(7.)

3 7 1 4 5
5 1 7 1 4
6 0 8 4 5
3 7 8 5 7
6 1 7 8 4
5 2 1 0 1

(8.)
64273
17845
37256
25417
61723
38419
72843

(9.)
84128
93714
37147
18321
71437
51726
72513

(10.)
52637
27196
38419
53192
61084
37195
29147

(11.)
942317829
742106108
610042796
762314572
600041234
704136053
567809387

(12.)
371845687
511704229
19460372
8340734
270155
36023
1950

(13.)
962430646
46281451
2160432
87610425
346214
40309
9827

(14.)
259000
3400045
5404433
37055326
4052174
406476269
2068591

☞ To prove Addition, begin at the top of the sum, and reckon the figures downwards in the same manner as they were added upwards, and if it be right, this sum total will be equal to the first: Or cut off the upper line of figures, and find the amount of the rest; then if the amount and upper line, when added, be equal to the total, the work is *supposed to be* right.

2. There is another method of proof, as follows:— Reject or cast out the nines in each row or sum of figures, and set down the remainders, each directly even with the figures in its row; find the sum of these remainders; then if the excess of nines in the sum found as before, is equal to the excess of nines in the sum total, the work is supposed to be right.

EXAMPLE.	Excess of 9's
3 7 8 2	2
5 7 6 6	6
8 7 5 5	7
18 3 0 3	6

15. Add 8635, 2194, 7421, 5063, 2196, and 1245 together. *Ans.* 26754.

16. Find the sum of 3482, 783645, 318, 7530, and 9678045. *Ans.* 10473020.

17. Find the sum total of 604, 4680, 98, 64, and 54. *Ans.* Fifty-five hundred.

18. What is the sum total of 24674, 16742, 34678, 10467, and 13439? *Ans.* One hundred thousand.

19. Add 1021, 3489, 28763, 289, and 6438 together. *Ans.* Forty thousand.

20. What is the sum total of the following numbers, viz. 2340, 1066, 3700, and 4005? *Ans.* 11111.

21. What is the sum total of the following numbers, viz.
Nine hundred and forty-seven,
Seven thousand six hundred and five,
Forty-five thousand six hundred,
Three hundred and eleven thousand,
Nine millions, and twenty-five,
Fifty-two millions, and nine thousand?

Answer, 61374177

22. Required the sum of the following numbers, viz.
Five hundred and sixty-eight,
Eight thousand eight hundred and five,
Seventy-nine thousand six hundred,
Nine hundred and eleven thousand,
Nine millions and twenty-six.

Answer, 9999999

QUESTIONS.

1. What number of dollars are in six bags, containing each 37542 dollars? *Ans.* 225252.

2. If one quarter of a ship's cargo be worth eleven thousand and ninety-nine dollars, how many dollars is the whole cargo worth? *Ans.* 44396 dols.

3. Money was first made of gold and silver at Argos, eight hundred and ninety-four years before Christ; how long has money been in use at this date, 1814? *Ans.* 2708 years.

4. The distance from Portland in the Province of Maine, to Boston, is 125 miles; from Boston to New-Haven, 162 miles; from thence to New-York, 88; from thence to Philadelphia, 95; from thence to Baltimore, 102; from thence to Charleston, South-Carolina, 716; and from thence to Savannah, 119 miles—What is the whole distance from Portland to Savannah? *Ans.* 1407 miles.

5. John, Thomas, and Harry, after counting their prize money, John had one thousand three hundred and seventy-five dollars; Thomas had just three times as many as John; and Harry had just as many as John and Thomas both—Pray how many dollars had Harry? *Ans.* 5500 dollars.

FEDERAL MONEY.

NEXT in point of simplicity, and the nearest allied to whole numbers, is the coin of the United States, or

FEDERAL MONEY.

This is the most simple and easy of all money—it increases in a tenfold proportion, like whole numbers.

10 mills, (*m.*) make	1 cent,	marked	*c.*
10 cents,	1 dime,		*d.*
10 dimes,	1 dollar,		*$.*
10 dollars,	1 Eagle,		*E.*

Dollar is the money unit; all other denominations being valued according to their place from the dollar's place. A point or comma, called a *separatrix*, may be placed *after the dollars* to separate them from the inferior denominations; then the first figure at the right of this separatrix is dimes, the second figure cents, and the third mil.s.*

ADDITION OF FEDERAL MONEY.

RULE.

1. Place the numbers according to their value; that is, dollars under dollars, dimes under dimes, cents under cents, &c. and proceed exactly as in whole numbers; then place the separatrix in the sum total, directly under the separating points above.

EXAMPLES.

$.	d. c. m.	$.	d. c. m.	$.	d. c. m.
365,	5 4 1	439,	3 0 4	136,	5 1 4
487,	0 6 0	416,	3 9 0	125,	0 9 0
94,	6 7 0	168,	9 3 4	200,	9 0 9
439,	0 8 9	239,	0 6 0	304,	0 0 6
742,	5 0 0	143,	0 0 5	111,	1 9 1
2128,	8 6 0				

2. When accounts are kept in dollars and cents, and no other denominations are mentioned, which is the usual mode in common reckoning, then the two first figures at the right of the separatrix or point, may be called so many cents instead of dimes and cents; for the place of dimes is only the ten's place in cents; because ten cents make a dime; for example, 48, 75, forty-eight dollars, seven dimes five cents, may be read forty-eight dollars and seventy-five cents.

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* It may be observed that all the figures at the left hand of the separatrix are dollars; or you may call the first figure dollars, and the other eagles, &c. Thus any sum of this money may be read differently, either wholly in the lowest denomination, or partly in the higher, and partly in the lowest; for example, 37 54, may be either read 3754 cents, or 375 dimes and 4 cents, or 37 dollars 5 dimes and 4 cents, or *3 eagles,* 7 dollars 5 dimes and 4 cents.

If the cents are less than ten, place a cypher in the ten's place, or place of dimes.—*Example.* Write down four dollars and 7 cents. Thus, $4, 07 *cts.*

EXAMPLES.

1. Find the sum of 304 dollars, 39 cents; 291 dollars, 9 cents; 136 dollars, 99 cents; 12 dollars and 10 cents.

Thus,
304, 39
291, 09
136, 99
12, 10

Sum, *744, 57* Seven hundred forty-four dollars and fifty-seven cents.

(2.)		(3.)		(4.)	
$.	*cts.*	$.	*cts.*	$.	*cts.*
0,	99	364,	00	3287,	80
0,	50	21,	50	1729,	19
0,	25	8,	09	4249,	99
0,	75	0,	99	140.	01

(5.)	(6.)		(7.)	
$.	$.	*cts.*	$.	*cts.*
2468	124,	50	,	16½
1900	9,	07	,	99
246	0,	60	,	86½
146	231,	01	,	17
167	0,	75	,	67½
46	24,	00	,	72
19	9,	44	,	99
8	0,	95	,	09

8. What is the sum total of 127 dols. 19 cents, 278 dols. 19 cents, 34 dols. 7 cents, 5 dols. 10 cents, and 1 dol. 99 *cents?* *Ans.* $446, 54 cts.

9. What is the sum of 378 dols. 1 ct. 136 dols. 91 cts. 344 dols. 8 cts. and 365 dols.? *Ans.* $1224.

10. What is the sum of 46 cents, 52 cents, 92 cents and 10 cents? *Ans.* $2.

11. What is the sum of 9 dimes, 8 dimes, and 80 cents? *Ans.* $2½.

12. I received of A B and C a sum of money; A paid me 95 dols. 43 cts. B paid me just three times as much as A, and C paid me just as much as A and B both; can you tell me how much money C paid me? *Ans.* $381, 72 cents.

13. There is an excellent well built ship just returned from the Indies. The ship only is valued at 12145 dols. 86 cents; and one quarter of her cargo is worth 25411 dols. 65 cents. Pray what is the value of the whole ship and cargo? *Ans.* $113792, 46 cts.

A TAILOR'S BILL.

Mr. James Paywell,

To Timothy Taylor, Dr.

		$. cts.	$. cts.
1814,			
April 15.	To 2½ yds. of Cloth, at	6, 50 per yd.	16 25
	To 4 yds. Shalloon,	75	3 00
	To making your Coat,		2 50
	To 1 silk Vest Pattern,		4 10
	To making your Vest,		1 50
	To Silk, Buttons, &c. for Vest,		0 45
		Sum,	$ 27 80

☞ By an act of Congress, all the accounts of the United States, the salaries of all officers, the revenues, &c. are to be reckoned in federal money; which mode of reckoning is so simple, easy and convenient, that it will soon come into common practice throughout all the States.

SIMPLE SUBTRACTION.

Subtraction of whole Numbers,

TEACHETH to take a less number from a greater, of the same denomination, and thereby shows the difference, or remainder : as 4 dollars subtracted from 6 dollars, the remainder is two dollars.

RULE.

Place the least number under the greatest, so that units may stand under units, tens under tens, &c. and draw a line under them.

2. Begin at the right hand, and take each figure in the lower line from the figure above it, and set down the remainder.

3. If the lower figure is greater than that above it, add ten to the upper figure ; from which number so increased, take the lower and set down the remainder, carrying one to the next lower number, with which proceed as before, and so on till the whole is finished.

PROOF. Add the remainder to the least number, and if the sum be equal to the greatest, the work is right.

[EXAMPLES.]

	(1.)	(2.)	(3.)
Greatest number,	2 4 6 8	6 2 1 5 7	8 7 9 6 4 7 5
Least number,	1 3 4 6	1 2 1 4 8	1 6 4 3 4 8 9
Difference,			
Proof,			

	(4.)	(5.)	(6.)
From	41678839	918764520	65432167890
Take	31542999	91243806	12345697098
Rem.			

	(7.)	(8.)
From	917144043605	3562176255002
Take	40600832164	1235271082165
Rem.		

	(9.)	(10.)	(11.)	(12.)
From	100000	2521665	200000	10000
Take	65321	2000000	99999	1
Diff.				

13. From 360418, take 293752. *Ans.* 66666.
14. From 765410, take 34747. *Ans.* 730663.
15. From 341209, take 198765. *Ans.* 142444.
16. From 100046, take 10009. *Ans.* 90037.
17. From 2637804, take 2376982. *Ans.* 260822.

18. From ninety thousand, five hundred and forty-six, take forty-two thousand, one hundred and nine. *Ans.* 48437.

19. From fifty-four thousand and twenty-six, take nine thousand two hundred and fifty-four. *Ans.* 44772.

20. From one million, take nine hundred and ninety-nine thousand. *Ans.* One thousand.

21. From nine hundred and eighty-seven millions, take nine hundred and eighty-seven thousand. *Ans.* 986013000.

22. Subtract one from a million, and shew the remainder. *Ans.* 999999.

QUESTIONS.

1. How much is six hundred and sixty-seven, greater than three hundred and ninety-five? *Ans.* 272.

2. What is the difference between twice twenty-seven, and three times forty-five? *Ans.* 81.

3. How much is 1200 greater than 365 and 721 added together? *Ans.* 114.

4. From New-London to Philadelphia is 240 miles. Now if a man should travel five days from New-London towards Philadelphia, at the rate of 39 miles each day, how far would he then be from Philadelphia. *Ans.* 45 miles.

5. What other number with these four, viz. 21, 32, 16, and 12, will make 100? *Ans.* 19.

6. A wine merchant bought 721 pipes of wine for 90846 dollars, and sold 543 pipes thereof for 89049 dollars; how many pipes has he remaining or unsold, and what do they stand him in?

Ans. 178 pipes unsold, and they stand him in $1797.

SUBTRACTION OF FEDERAL MONEY.

RULE.

Place the numbers according to their value; that is, dollars under dollars, dimes under dimes, cents under cents, &c. and subtract as in whole numbers.

EXAMPLES.

	$.	*d. c. m.*
From	45,	4 7 5
Take	43,	4 8 5
Rem.	$ 1,	9 9 0

one dollar, nine dimes, and nine cents, or one dollar and ninety-nine cents.

	$.	*d. c.*	$.	*d. c. m.*	$.	*d. c. m.*
From	45,	7 4	46,	2 4 6	211,	1 1 0
Take	13,	8 9	36,	1 6 4	111,	1 1 4
Rem.						

	$.	$.	*cts.*	$.	*cts.*
From	4 2 8 4	411,	24	960,	00
Take	1 9 9 3	16,	09	136,	41
Rem.					

	$.	*cts.*	$.	*cts.*	$.	*cts.*
From	4106,	71	1901,	08	365,	00
Take	221,	69	864,	09	109,	01

11. From 125 dollars, take 9 dollars 9 cents.
Ans. $115, 91 cts.

12. From 127 dollars 1 cent, take 41 dollars 10 cents.
Ans. $85, 91 cts.

13. From 365 dollars 90 cents, take 168 dols. 99 cents. *Ans.* $196, 91 cts.

14. From 249 dollars 45 cents, take 180 dollars. *Ans.* $69, 45 cts.

15. From 100 dollars, take 45 cts. *Ans.* $99, 55 cts.

16. From ninety dollars and ten cents, take forty dollars and nineteen cents. *Ans.* $49, 91 cts.

17. From forty-one dollars eight cents, take one dollar nine cents. *Ans.* $39, 99 cts.

18. From 3 dols. take 7 cts. *Ans.* $2, 93 cts.

19. From ninety-nine dollars, take ninety-nine cents. *Ans.* $98, 1 ct.

20. From twenty dols. take twenty cents and one mill. *Ans.* $19, 79 cts. 9 mills.

21. From three dollars, take one hundred and ninety-nine cents. *Ans.* $1, 1 ct.

22. From 20 dols. take 1 dime. *Ans.* $19, 90 cts.

23. From nine dollars and ninety cents, take ninety-nine dimes. *Ans.* 0 remains.

24. Jack's prize money was 219 dollars, and Thomas received just twice as much, lacking 45 cents. How much money did Thomas receive? *Ans.* $437, 55 cts.

25. Joe Careless received prize money to the amount of 1000 dollars; after which he lays out 411 dols. 41 cents for a span of fine horses; and 123 dollars 40 cents for a gold watch and a suit of new clothes; besides 359 dols. and 50 cents he lost in gambling. How much will he have left after paying his landlord's bill, which amounts to 85 dols. and 11 cents? *Ans.* $20, 58 cts.

SIMPLE MULTIPLICATION,

TEACHETH to increase, or repeat the greater of two numbers given, as often as there are units in the less, or multiplying number; hence it performs the work of many additions in the most compendious manner.

The number to be multiplied is called the multiplicand.

The number you multiply by, is called the multiplier.

The number found from the operation, is called the *product.*

NOTE.—Both multiplier and multiplicand are in general called factors, or terms.

CASE I.

When the multiplier is not more than twelve.

RULE.

Multiply each figure in the multiplicand by the multiplier; carry one for every ten, (as in addition of whole numbers) and you will have the product or answer.

PROOF.*

Multiply the multiplier by the multiplicand.

EXAMPLES.

What number is equal to 3 times 365?

Thus,	365	*multiplicand.*
	3	*multiplier.*
Ans.	1095	*product.*

Multiplicand	74635	5432	2345	9075
Multiplier	3	4	5	6
Product				

47094	71034	31261	4320
7	8	9	10

1432046	2240613	4684114
11	12	12

CASE II.

When the multiplier consists of several figures.

RULE.

The multiplier being placed under the multiplicand units under units, tens under tens, &c. multiply by each significant figure in the multiplier separately, placing the first figure in each product exactly under its multiplier;

---

* Multiplication may also be proved by casting out the 9's in the two factors, and setting down the remainders; then multiplying the two remainders together; if the excess of 9's in their product is equal to the excess of 9's in the total product, the work is supposed to be right.

then add the several products together in the same order as they stand, and their sum will be the total product.

EXAMPLES.

What number is equal to 47 times 365?

Multiplicand	3 6 5
Multiplier	4 7
	2 5 5 5
	1 4 6 0
Ans.	1 7 1 5 5 *product*

Multiplicand,	37864	34293	47042
Multiplier,	209	74	91
	340776		
	75728		
Product,	7913576	2537682	4280822

8253	25203	2193	9876
826	4025	4072	9405
6816978	101442075	8929896	92883780

269181	261986	40634
4629	7638	42068
1246038849	2001049068	1709391112

134092	918273645
87362	1003245
11714545304	921253442978025

14. Multiply 760483 by 9152. *Ans.* 6959940416.

15. What is the total product of 7608 times 365432? *Ans.* 2780206656.

16. What number is equal to 40003 times 4897685? *Ans.* 195922093055.

CASE III.

When there are cyphers on the right hand of either or both of the factors, neglect those cyphers; then place the significant figures under one another, and multiply by them only, and to the right hand of the product, place as many cyphers as were omitted in both the factors.

EXAMPLES.

21200 31800 84600
70 36 34000
1484000 1144800 2876400000

35926000 82530
3040 98260000
109215040000 8109397800000

7065000×8700=61465500000
749643000×695000=521001885000000
360000×1200000=432000000000

CASE IV.

When the multiplier is a composite number, that is, when it is produced by multiplying any two numbers in the table together; multiply first by one of those figures and that product by the other; and the last product will be the total required.

EXAMPLES.

Multiply 41364 by 35.
7×5=35. 7
289548 Product of 7
5
1447740 Product of 35

2. Multiply 764131 by 48. *Ans.* 36678288.
3. Multiply 342516 by 56. *Ans.* 19180896.
4. Multiply 209402 by 72. *Ans.* 15076944.
5. Multiply 91738 by 81. *Ans.* 7430778.
6. Multiply 34462 by 108. *Ans.* 3721896.
7. *Multiply* 615243 by 144. *Ans.* 88594992.

CASE V.

To multiply by 10, 100, 1000, &c. annex to the multiplicand all the cyphers in the multiplier, and it will make the product required.

EXAMPLES.

1. Multiply 365 by 10. *Ans.* 3650.
2. Multiply 4657 by 100. *Ans.* 465700.
3. Multiply 5224 by 1000. *Ans.* 5224000.
4. Multiply 26460 by 10000. *Ans.* 264600000.

EXAMPLES FOR EXERCISE.

1. Multiply 1203450 by 9004. *Ans.* 10835863800.
2. Multiply 9087061 by 56708. *Ans.* 515309055188.
3. Multiply 8706544 by 67089. *Ans.* 584113330416.
4. Multiply 4321209 by 123409. *Ans.* 533276081481.
5. Multiply 3456789 by 567090. *Ans.* 1960310474010.
6. Multiply 8496427 by 874359. *Ans.* 7428927415293.

98763542×98763542=8754237228385764.

Application and Use of Multiplication.

In making out bills of parcels, and in finding the value of goods; when the price of one yard, pound, &c. is given (in Federal Money) to find the value of the whole quantity.

RULE.

Multiply the given price and quantity together, as in whole numbers, and the separatrix will be as many figures from the right hand in the product, as in the given price.

EXAMPLES.

1. What will 35 yards of broadcloth come to, at } $ *d. c. m.* 3, 4 9 6 per yard?

3, 4 9 6
3 5

17 4 8 0
104 8 8

Ans. $122, 3 6 0 =122 dollars, 36 cents.

2. What cost 35 lb. cheese at 8 cents per lb.?

35
,08

Ans. $2, 80=2 dollars 80 cents.

3. What is the value of 29 pairs of men's shoes, at 1 dollar 51 cents per pair? *Ans.* $43, 79 cents.

4. What cost 131 yards of Irish linen, at 38 cents per yard? *Ans.* $49, 78 cents.

5. What cost 140 reams of paper, at 2 dollars 35 cents per ream? *Ans.* $329.

6. What cost 144 lb of hyson tea, at 3 dollars 51 cents per lb.? *Ans.* $505, 44 cents.

7. What cost 94 bushels of oats, at 33 cents per bushel? *Ans.* $31, 2 cents.

8. What do 50 firkins of butter come to, at 7 dollars 14 cents per firkin? *Ans.* $357.

9. What cost 12 cwt. of Malaga raisins, at 7 dollars 31 cents per cwt.? *Ans.* $87, 72 cents.

10. Bought 37 horses for shipping, at 52 dollars per head; what do they come to? *Ans.* $1924.

11. What is the amount of 500 lbs. of hog's-lard, at 15 cents per lb.? *Ans.* $75.

12. What is the value of 75 yards of satin, at 3 dollars 75 cents per yard? *Ans.* $281, 25 cents.

13. What cost 367 acres of land, at 14 dols. 67 cents per acre? *Ans.* $5383, 89 cents.

14. What does 857 bls. pork come to, at 18 dols. 98 cents per bl.? *Ans.* $16223, 1 cent.

15. What does 15 tons of Hay come to, at 20 dols. 78 cts. per ton? *Ans.* $311, 70 cents.

16. Find the amount of the following

BILL OF PARCELS.

New-London, March 9, 1814.

Mr. James Paywell, Bought of *William Merchant.*

	$. cts.
28 lb. of Green Tea,	at 2, 15 *per lb.*
41 lb. of Coffee,	at 0, 21
34 lb. of Loaf Sugar,	at 0, 19
13 cwt. of Malaga Raisins,	at 7, 31 *per cwt.*
35 firkins of Butter,	at 7, 14 *per fir.*
27 pairs of worsted Hose,	at 1, 04 *per pair.*
94 bushels of Oats,	at 0, 33 *per bush.*
29 pairs of men's Shoes,	at 1, 12 *per pair.*

Amount, $510, 78.

Received payment in full, WILLIAM MERCHANT.

A SHORT RULE.

Note. The value of 100 lbs. of any article will be just as many dollars as the article is cents a pound.

For 100 lb. at 1 cent per lb.=100 cents=1 dollar.

100 lb. of beef at 4 cents a lb. comes to 400 cents=4 dollars, &c.

DIVISION OF WHOLE NUMBERS.

Simple division teaches to find how many times one whole number is contained in another; and also what remains; and is a concise way of performing several subtractions.

Four principal parts are to be noticed in Division:

1. The *Dividend*, or number given to be divided.
2. The *Divisor*, or number given to divide by.
3. The *Quotient*, or answer to the question, which shows how many times the divisor is contained in the dividend.
4. The *Remainder*, which is always less than the divisor, and of the same name with the Dividend.

RULE.

First, seek how many times the divisor is contained in as many of the left hand figures of the dividend as are just necessary, (that is, find the greatest figure that the divisor can be multiplied by, so as to produce a product that shall not exceed the part of the dividend used) when found, place the figure in the quotient; multiply the divisor by this quotient figure; place the product under that part of the dividend used; then subtract it therefrom, and bring down the next figure of the dividend to the right hand of the remainder; after which, you must seek, multiply and subtract, till you have brought down every figure of the dividend.

Proof. Multiply the divisor and quotient together and add the remainder if there be any to the product; if the work be right, the sum will be equal to the dividend.*

---

* Another method which some make use of to prove division is as follows: viz. Add the remainder and all the products of the several quotient figures multiplied by the divisor

EXAMPLES.

1. How many times is 4 contained in 9391?

Divisor,Div.Quotient.

4)9391(2347
8 4
—
13 9388
12 +3 *Rem.*
—
19 9391 *Proof.*
16
—
31
28
—
3 *Remainder.*

2. Divide 3656 dollars equally among 8 men.

Divisor,Div.Quotient.

8)3656(457
32
—
45
40
—
56
56
—
3656 *Proof by addition.*

Divisor,Div.Quotient

29)15359(529
145
—
85
58
—
279
261
—
Remains 18

Proof by excess of 9's

5
2 X 7
5

365)49640(136
365
—
1314
1095
—
2190
2190
—
0 *Rem.*

---

together, according to the order in which they stand in the work; and this sum, when the work is right will be equal to the dividend.

A third method of proof by excess of nines is as follows, viz.

1. Cast the nines out of the divisor and place the excess on the left hand.

2. Do the same with the quotient and place it on the right hand.

3. Multiply these two figures together, and add their product to the remainder, and reject the nines and place the excess at top.

4. Cast the nines out of the dividend and place the excess at bottom.

NOTE. If the sum is right the top and bottom figures will be alike.

Divisor. Div. Quotient. 95)85595(901
61)28609(469 736)863256(1172
472)251104(532 *there remains* 664

9. Divide 1893312 by 912. *Ans.* 2076.
10. Divide 1893312 by 2076. *Ans.* 912.
11. Divide 47254149 by 4674. *Ans.* 10110$\frac{9}{4674}$.
12. What is the quotient of 330098048 divided by 4207? *Ans.* 78464.
13. What is the quotient of 761858465 divided by 8465? *Ans.* 90001.
14. How often does 761858465 contain 90001? *Ans.* 8465.
15. How many times 38473 can you have in 119184693? *Ans.* 3097$\frac{33812}{38473}$.
16. Divide 280208122081 by 912314. *Quotient* 307140$\frac{121}{912314}$.

MORE EXAMPLES FOR EXERCISE.

Divisor.	*Dividend.*		*Remainder.*
234063)	590624922(	*Quotient*)	83973
47614)	327879186(	)	9182
987654)	988641654(	)	...0

CASE II.

When there are cyphers at the right hand of the divisor; cut off the cyphers in the divisor, and the same number of figures from the right hand of the dividend, then divide the remaining ones as usual, and to the remainder (if any) annex those figures cut off from the dividend, and you will have the true remainder.

EXAMPLES.

1. Divide 4673625 by 21400.

```
214(00)46736)25(218 8425/21400 true quotient by Restitution.
       428
       ---
        393
        214
        ---
        1796
        1712
        ----
          84 25 true rem.
```

2. Divide 379432675 by 6500 *Ans.* $58374\frac{1675}{6500}$
3. Divide 421400000 by 49000. *Ans.* 8600
4. Divide 11659112 by 89000 *Ans.* $131\frac{112}{89000}$
5. Divide 9187642 by 9170000. *Ans.* $1\frac{17642}{9170000}$

MORE EXAMPLES.

Divisor.	*Dividend.*		*Remains.*
125000)	436250000(	*Quotient.*)	0
120000)	149596478(	)	76478
901000)	654347230(	)	221230
720000)	987654000(	)	534000

CASE III.

Short Division is when the divisor does not exceed 12.

RULE.

Consider how many times the divisor is contained in the first figure or figures of the dividend, put the result under, and carry as many tens to the next figure as there are ones over.

Divide every figure in the same manner till the whole is finished.

EXAMPLES.

Divisor. Dividend.

2)113415 3)85494 4)39407 5)94379

Quotient 56707—1

6)120616 7)152715 8)96872 9)118724

11)6986197 12)14814096 12)570196382

Contractions in Division.

When the divisor is such a number, that any two figures in the Table, being multiplied together will produce it, divide the given dividend by one of those figures; the quotient thence arising by the other; and the last quotient will be the answer.

NOTE. The total remainder is found by multiplying the last remainder by the first divisor, and adding in the first remainder.

EXAMPLES.

Divide 162641 by 72.

9)162641	or	8)162641	*last rem.* 7
8)18071—2		9)20330—1	×9
2258—7		2258—8	63
			first rem. +2
	True Quotient 2258$\frac{65}{72}$		
			True rem. 65

2. Divide 178464 by 16. *Ans.* 11154
3. Divide 467412 by 24. *Ans.* 19475$\frac{12}{24}$
4. Divide 942341 by 35. *Ans.* 26924$\frac{1}{35}$
5. Divide 79638 by 36. *Ans.* 2212$\frac{6}{36}$
6. Divide 144872 by 48. *Ans.* 3018$\frac{8}{48}$
7. Divide 937387 by 54. *Ans.* 17359$\frac{1}{54}$
8. Divide 93975 by 84. *Ans.* 1118$\frac{63}{84}$
9. Divide 145260 by 108. *Ans.* 1345
10. Divide 1575360 by 144. *Ans.* 10940

2. To divide by 10, 100, 1000, &c.

RULE.

Cut off as many figures from the right hand of the dividend as there are cyphers in the divisor, and these figures so cut off are the remainder; and the other figures of the dividend are the quotient.

EXAMPLES.

1. Divide 365 by 10. *Ans.* 36 and 5 *remains*
2. Divide 5762 by 100. *Ans.* 57 —62 *rem.*
3. Divide 763753 by 1000. *Ans.* 763 —753 *rem.*

SUPPLEMENT TO MULTIPLICATION.

To multiply by a mixt number; that is a whole number joined with a fraction, as 8¼, 5½, 6¾, &c.

RULE.

Multiply by the whole number, and take ¼, ½, ¾, &c. of *the Multiplicand*, and add it to the product.

EXAMPLES.

Multiply 37 by 23½.	Multiply 48 by 2¾.
2)37	48
23½	2¾
18½	24=½
111	12=¼
74	96
869½ *Answer.*	132 *Ans.*

3. Multiply 211 by 50½. *Ans.* 10655½
4. Multiply 2464 by 8⅓. *Ans* 20533⅓.
5. Multiply 345 by 19⅛. *Ans.* 659 ⅛
6. Multiply 6497 by 5⅐. *Ans.* 3341 ⅐

* * *

Questions to Exercise Multiplication and Division.

1. What will 9¾ tons of hay come to, at 14 dollars a ton? *Ans.* $136½.

2. If it takes 320 rods to make a mile, and every rod contains 5½ yards; how many yards are there in a mile? *Ans.* 1760.

3. Sold a ship for 11516 dollars, and I owned ¾ of her; what was my part of the money? *Ans.* $8637.

4. In 276 barrels of raisins, each 3½ cwt. how many hundred weight? *Ans.* 966 cwt.

5. In 36 pieces of cloth, each piece containing 24¼ yards; how many yards in the whole? *Ans.* 873 yds.

6. What is the product of 161 multiplied by itself? *Ans.* 25921.

7. If a man spends 492 doll[illegible] year, what is that per calendar month? *Ans.* $41.

8. A privateer of 65 men took a prize, which being equally divided among them, amounted to 119*l.* per man; what is the value of the prize? *Ans.* £7735.

9 What number multiplied by 9, will make 225? *Ans.* 25.

10. The quotient of a certain number is 457, and the divisor 8; what is the dividend? *Ans.* 3656.

11. what cost 9 yds. of cloth, at 3*s.* per yard? *Ans.* 27s.

12. *What cost 45 oxen,* at 8*l.* per head? *Ans.* £360.

13. What cost 144 lb. of Indigo, at 2 dols. 50 cts. or 250 cents per lb. *Ans.* $360.

14. Write down four thousand six hundred and seventeen, multiply it by twelve, divide the product by nine, and add 365 to the quotient, then from that sum subtract five thousand five hundred and twenty-one, and the remainder will be just 1000. Try it and see.

COMPOUND ADDITION,

Is the adding of several numbers together, having different denominations, but of the same generic kind, as pounds, shillings and pence, &c. Tons, hundreds, quarters, &c.

RULE.*

1. Place the numbers so that those of the same denomination may stand directly under each other.

2. Add the first column or denomination together, as in whole numbers; then divide the sum by as many of the same denomination as make one of the next greater; setting down the remainder under the column added, and carry the quotient to the next superior denomination, continuing the same to the last, which add, as in simple addition.

1. STERLING MONEY,

Is the money of accou[illegible]n Great-Britain, and is reckoned in Pounds, Shillings, Pence and Farthings. See the Pence Tables.

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* The reason of this rule is evident: For, addition of this money, as 1 in the pence is equal to 4 in the farthings; 1 in the shillings, to 12 in the pence; and 1 in the pounds, to 20 in the shillings; therefore carrying as directed, is the arranging the money, arising from each column, properly in the scale of denominations; and this reasoning will hold good *in the addition* of compound numbers of any denomination *whatever.*

EXAMPLES.

What is the sum total of 47*l.* 13*s.* 6*d.*—19*l.* 2*s.* 9½*d.*—14*l.* 10*s.* 11¼*d.* and 12*l.* 9s. 1¾*d.*?

	£.	s.	d.
Thus	47	13	6
	19	2	9½
	14	10	11¼
	12	9	1¾
Answer, £.	93	16	4½

(2)

£.	s.	d.
17	13	11
13	10	2
10	17	3
8	8	7
3	3	4

(3)

£.	s.	d.	qr.
84	17	5	3
75	13	4	3
50	17	8	2
20	10	10	1
	16	5	0

(4)

£.	s.	d.	qr.
30	11	4	2
15	10	9	1
1	0	1	1
3	9	8	3
4	6	3	1

(5)

£.	s.	d.	qr.
47	17	6	2
3	9	10	3
59	17	11	2
317	16	9	3
762	19	10	1
407	17	6	2
1	19	9	

(6)

£.	s.	d.	qr.
7	17	10	3
60	6	8	0
7	14	11	2
18	19	9	3
91	15	8	2
18	17	10	3
5	0	1	2

(7)

£.	s.	d.	qr.
541	0	0	0
711	9	8	1
918	6	9	3
140	15	10	1
300	19	11	3
48	10	7	3
0	14	9	3

(8)

£.	s.	d.
105	17	6
193	10	11
901	13	0
319	19	7
48	17	4
104	11	9
90	16	7
111	9	9
976	0	10
449	12	6
29	10	4

(9)

£.	s.	d.
940	10	7
36	[illegible]	11
11	[illegible]	0
141	10	6
126	14	0
104	19	7
160	10	6
100	0	0
9	0	9
0	19	6
120	0	8

(10)

£.	s.	d.
97	11	6½
20	0	4
144	1	10
17	11	9
9	16	10½
0	19	9½
19	9	4
234	11	10¼
180	14	6
421	10	3¼
341	10	4

11. Find the amount of the following sums, viz. 42*l.* 13*s.* 5*d.*—11*l.* 10*s.*—4*l.* 17*s.* 8*d.*—13*l.* 0*s.* 7*d.*—19*s.* 4½*d.*—27*l* and 15*l.* 6*s.* £. s. d.

Ans. £. 115 7 0½

12. Add 304*l.* 5*s.* and 0½*d.*—34*l.* 19*s.* 7*d*—7*l.* 18*s.* 5*d.*—247*l.* 0*s.* 11*d.*—19*s.* 6*d.* 1*qr.* and 45*l.* together.

Ans. £640 3*s.* 5¾*d.*

13. Find the sum total of 14*l.* 19*s.* 6*d.*—11*l.* 4*s.* 9*d.*—25*l.* 10*s.*—4*l.* 0*s.* 6*d.*—3*l.* 5*s.* 8*d.*—19*s.* 6*d.* and 0*s.* 6*d.*

Ans. £60 0*s.* 5*d.*

14. Find the amount of the following sums, viz.

Forty pounds, nine shillings, - - - - - £. s. d.
Sixty-four pounds and nine pence, - -
Ninety-five pounds, nineteen shillings, -
Seventeen shillings and 4½d. - - - -

Ans. £. 201 6 1½

15. How much is the sum of

Thirty-seven shillings and six pence, -
Thirty-nine shillings and 4½d. - - - -
Forty-four shillings and nine pence, - -
Twenty-nine shillings and three pence, -
Fifty-shillings, - - - - - - - - - - -

Ans. £. 10 0*s.* 10½*d.*

16. Bought a quantity [illegible] goods for 125*l.* 10*s.* paid for truckage forty-five shillings, for freight seventy-nine shillings and six pence, for duties thirty-five shillings and ten pence, and my expences were fifty-three shillings and nine pence; what did the goods stand me in?

Ans. £. 136 4*s.* 1*d.*

17. Six men took a prize, and having divided it equally amongst them, each man shared two hundred and forty pounds, thirteen shillings and seven pence; how much money did the whole prize amount to?

Ans. £. 1444 1*s.* 6*d.*

2. TROY WEIGHT.

lb.	*oz.*	*pwt.*	*gr.*
16	11	19	23
4	4	16	21
8	8	19	14
6	9	14	17
4	7	10	7
0	7	11	12

lb.	*oz.*	*pwt.*	*gr.*
8	11	19	21
6	10	16	8
7	8	17	21
4	6	8	23
9	7	14	17
7	9	13	10

3. AVOIRDUPOIS WEIGHT.

cwt.	*qr.*	*lb.*
2	3	27
1	1	17
4	2	26
6	1	13
3	3	15
6	2	16

lb.	*oz.*	*dr.*
24	13	14
17	12	11
26	12	15
16	8	7
24	10	12
11	12	12

T.	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
91	17	2	24	13	14
19	9	0	17	10	12
14	13	2	04	9	11
47	11	3	19	14	5
69	00	1	00	00	12
77	19	3	27	15	11

4. APOTHECARIES WEIGHT.

ʒ	℈	*gr.*
9	1	17
3	2	9
6	1	17
4	0	16
5	2	12
6	1	10

℥	ʒ	℈	*gr.*
10	7	2	19
6	3	0	12
7	6	1	7
9	5	2	12
6	1	0	16
9	3	2	19

℔	℥	ʒ	℈	*gr.*
12	11	6	1	15
4	9	7	0	12
9	10	1	2	16
4	8	1	2	19
9	0	0	1	10
4	9	2	1	6

5. CLOTH MEASURE.

yd.	*qr.*	*na.*
71	3	3
13	2	1
10	0	1
42	3	3
57	2	2
49	2	2

E. E.	*qr.*	*na.*
44	3	2
49	4	3
06	2	3
84	4	1
07	0	0
61	2	1

E. F.	*qr.*	*na.*
84	2	1
07	1	3
76	0	2
32	2	3
53	2	2
09	2	3

6. DRY MEASURE.

pk.	qt.	pt.
1	7	1
2	6	0
1	5	0
2	4	1
2	6	1
3	6	0

bu.	pk.	qt.
17	2	5
34	2	7
13	3	6
16	3	4
27	2	6
56	0	7

bu.	pk.	qt.	pt
25	3	7	1
64	2	6	1
43	0	4	0
52	3	5	1
94	2	3	0
54	3	7	0

7. WINE MEASURE.

gal.	qt.	pt.	gi.
39	3	1	3
17	2	1	2
24	3	0	1
19	1	1	2
8	0	0	3
40	2	1	1

hhd.	gal.	qt.	pt.
42	61	3	1
27	39	2	0
9	14	0	1
0	9	2	1
16	24	1	1
4	00	3	0

tun.	hhd.	gal.	qt.
34	2	34	2
19	1	59	1
28	2	2	1
19	0	32	2
37	3	11	1
0	1	9	0

8. LONG MEASURE.

yds.	ft.	in.	b.c.
4	2	11	2
3	1	8	1
1	2	9	2
6	2	10	1
1	0	6	1
3	1	7	0

m.	fur.	po.
46	4	16
58	5	23
9	6	34
17	4	18
7	3	15
5	2	24

le.	m.	fur.	po.
86	2	6	32
52	1	7	16
64	2	5	19
73	1	4	15
7	2	3	25
28	2	4	17

9. LAND OR SQUARE MEASURE.

acres.	roods.	rods.
478	3	31
816	2	17
49	1	27
63	3	34
9	3	37

acres.	roods.	rods.
856	2	18
19	3	00
9	1	39
1	3	00
0	2	27

sq.ft.	sq.in.
5	136
6	129
8	134
0	143
4	34

10. SOLID MEASURE.

T.	*ft.*
41	43
12	43
49	6
4	27

cords.	*feet.*
3	122
4	114
7	83
10	127

feet.	*inches.*
13	1446
16	1726
3	866
14	284

11. TIME.

Y.	*m.*	*w.*	*da.*
57	11	3	6
3	9	2	3
29	8	2	5
46	10	2	4
10	7	1	2

Yr.	*da.*	*h.*	*m.*	*sec.*
24	363	23	54	35
21	40	12	40	24
13	112	14	00	17
14	9	11	18	14
8	24	8	16	13

12. CIRCULAR MOTION.

S.	°	′	″
	29	17	14
	6	10	17
	18	17	11
	14	18	10

S.	°	′	″
11	29	59	59
0	00	40	10
9	4	10	49
4	11	6	10

COMPOUND SUBTRACTION,

TEACHES to find the difference, inequality or excess, between any two sums of diverse denominations.

RULE.

Place those numbers under each other, which are of the same denomination, the less being below the greater; begin with the least denomination, and if it exceed the figure over it, borrow as many units as make one of the next greater; subtract it therefrom; and to the difference add the upper figure, remembering always to add one to the next superior denomination for that which you borrowed.

Note. The method of proof is the same as in simple subtraction.

EXAMPLES.

1. *Sterling Money.*

	(1)	(2)	(3)
	£. s. d. qr.	*£. s. d. qr.*	*£. s. d.*
From	346 16 5 3	14 14 6 2	94 11 6
Take	128 17 4 2	10 19 6 3	36 14 8
Rem.	217 19 1 1		

	(4)		(5)
	£. s. d.		*£. s. d. qr.*
Borrowed	44 10 2	**Lent**	36 0 8 2
Paid	36 11 8	**Received**	18 10 7 3
Remains unpaid		**Due to me**	

	(6)	(7)	(8)
	£. s. d.	*£. s. d. qr.*	*£. s. d. qr.*
From	5 0 0	7 11 1 2	476 10 9 1
Take	4 19 11	4 17 3 1	277 17 7 1
Rem.			

	(9)	(10)	(11)
	£. s. d. qr.	*£. s. d.*	*£. s. d. qr.*
From	141 14 9 2	125 01 8	10 13 7 1
Take	19 13 10 2	124 19 8	0 9 6 3
Rem.			

12. Borrowed 27*l.* 11*s.* and paid 19*l.* 17*s.* 6*d.* how much remains due? *Ans.* £7 13*s.* 6*d.*

13. How much does 317*l.* 6*s.* exceed 178*l.* 18*s.* 5¼*d.*? *Ans.* £138 7*s.* 6¾*d.*

14. From eleven pounds take eleven pence. *Ans.* £10 19*s.* 1*d.*

15. *From* seven thousand two hundred pound, take *18l. 17s. 6½d.* *Ans.* £7181 2*s.* 5½*d.*

16. How much does seven hundred and eight pounds, exceed thirty-nine pounds, fifteen shillings and ten pence halfpenny? *Ans.* £668 4*s.* 1½*d.*

17. From one hundred pounds, take four pence halfpenny. *Ans.* £99 19*s.* 7½*d.*

18. Received of four men the following sums of money, viz. The first paid me 37*l.* 11*s.* 4*d.* the second 25*l.* 16*s.* 7*d.* the third 19*l.* 14*s.* 6*d.* and the fourth as much as all the other three, lacking 19*s.* 6*d.* I demand the whole sum received? *Ans.* £165 5*s.* 4*d.*

2. TROY WEIGHT.

	lb.	*oz.*	*pwt.*	*oz.*	*pwt.*	*gr.*	*lb.*	*oz.*	*pwt.*	*gr*
From	6	11	14	4	19	21	44	9	6	12
Take	2	3	16	2	14	23	17	3	16	18
Rem.										

lb.	*oz.*	*pwt.*	*gr.*
684	2	10	14
683	1	9	13

lb.	*oz.*	*pwt.*	*gr.*
942	2	0	0
892	9	2	3

3. AVOIRDUPOISE WEIGHT.

lb.	*oz.*	*dr.*
7	9	12
3	12	9

C.	*qr.*	*lb.*
7	3	13
5	1	15

T.	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
7	10	3	17	5	12
3	12	1	19	10	9

T.	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
810	11	0	20	10	11
193	17	1	20	12	14

T.	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
317	12	1	12	9	12
180	12	1	14	10	14

4. APOTHECARIES' WEIGHT.

℔	℥	ʒ
19	8	7
9	11	6

ʒ	℈	*gr.*
4	1	17
1	2	15

℔	℥	ʒ	℈	*gr.*
35	7	3	1	14
17	10	6	1	18

5. CLOTH MEASURE.

Yd.	*qr.*	*na.*
35	1	2
19	1	3

E.E.	*qr.*	*na.*
467	3	1
291	3	2

E.Fl.	*qr.*	*na.*
765	1	3
149	2	1

Yd.	*qr.*	*na.*
813	3	1
174	1	0

E.E.	*qr.*	*na.*
615	0	1
226	2	2

E.Fl.	*qr.*	*na.*
845	1	1
576	2	3

6. DRY MEASURE.

bu.	*pk.*	*qt.*
65	1	7
14	3	4

bu.	*pk.*	*qt.*
8	1	5
3	1	6

bu.	*pk.*	*qt.*	*pt.*
17	2	3	0
6	2	6	1

7. WINE MEASURE.

gal.	*qt.*	*pt.*	*gi.*
21	2	0	1
14	2	1	0

hhd.	*gal.*	*qt.*	*pt.*
13	0	1	0
10	60	3	1

T.	*hhd.*	*gal.*	*qt.*	*pt.*
2	3	20	3	1
1	2	27	0	0

hhd.	*gal.*	*qt.*	*pt.*
612	23	1	0
75	37	1	1

hhd.	*gal.*	*qt.*	*pt.*
521	14	2	1
256	25	3	0

8. LONG MEASURE.

yd.	*ft.*	*in.*	*b.c.*
4	2	11	0
2	2	11	1

m.	*fur.*	*po.*
41	6	22
10	6	23

le.	*m.*	*fur.*	*po.*
86	2	6	32
24	1	7	31

le.	*m.*	*fur.*	*po.*
27	1	6	37
19	2	4	39

le.	*m.*	*fur.*	*po.*
16	0	1	3
10	1	3	5

le.	*m.*	*fur.*	*po.*
9	2	0	7
1	1	1	8

9. LAND OR SQUARE MEASURE.

A.	*roods.*	*rods.*
29	1	10
24	1	25

A.	*r.*	*po.*
29	2	17
17	1	36

sq.ft.	*sq.in.*
399	131
19	132

A.	*qr.*	*rods.*
540	0	25
119	1	27

A.	*qr.*	*rods.*
130	1	10
49	1	11

sq.ft.	*sq.in.*
860	84
143	125

10. SOLID MEASURE.

tons.	*ft.*
116	24
109	39

cords.	*ft.*
72	114
41	120

tons.	*ft.*	*in.*
45	18	140
16	14	145

11. TIME.

yrs.	*mo.*	*w.*	*da.*
54	11	3	1
43	11	3	5

yrs.	*days.*	*h.*	*min.*	*sec.*
24	352	20	41	20
14	356	20	49	19

w.	*d.*	*h.*	*min.*	*sec.*
472	2	13	1[illegible]	42
218	4	16	2[illegible]	54

w.	*d.*	*h.*	*min.*	*sec.*
781	1	8	23	21
197	3	12	42	53

12. CIRCULAR MOTION.

S.	°	′	″
9	23	45	54
3	7	40	56

S.	°	′	
9	29	34	54
7	29	40	36

, 50
0, 45

QUESTIONS,

Shewing the use of Compound Addition and Subtraction.

NEW-YORK, MARCH 22, 1814.

1. Bought of *George Grocer*,

	£	s	d
12 C. 2 qrs. of Sugar, at 52*s.* per cwt.	£32	10	0
28 lbs. of Rice, at 3*d.* per lb.	0	7	0
3 loaves of Sugar, wt. 35lb. at 1*s.* 1*d.* per lb.	1	17	11
3 C. 2 qrs. 14lb. of Raisins, at 36*s.* per cwt.	6	10	6
	£41	5	5

2. What sum added to 17*l.* 11*s.* 8¼*d.* will make 100*l.*? *Ans.* 82*l.* 8*s.* 3*d.* 3*qr.*

3. Borrowed 50*l.* 10*s.* paid again at one time 17*l.* 11*s.* 6*d.* and at another time, 9*l.* 4*s.* 8*d.* at another time 7*l.* 9*s.* 6*d.* and at another time 19*s.* 6½*d.* how much remains unpaid? *Ans.* £15 4*s.* 9½*d.*

4. Borrowed 100*l.* and paid in part as follows, viz. at one time 21*l.* 11*s.* 6*d.* at another time 19*l.* 17*s.* 4½*d.* at another time 10 dollars at 6*s.* each, and at another time two English guineas at 28*s.* each and two pistareens, at 14½*d.* each; how much remains due, or unpaid? *Ans.* £52 12*s.* 8½*d.*

5. A, B, and C, drew their prize money as follows, viz. A had 75*l.* 15*s.* 4*d.* B had three times as much as A, lacking 15*s*, 6*d.* and C, had just as much [illegible] A and B both; pray how much had C? *Ans.* £302 5*s.* 10*d.*

6. I lent Peter Trusty 1000 dols. and afterwards lent him 26 dols. 45 cts. more. He has paid me at one time 361 dols. 40 cts. and at another time 416 dols. 09 cts. besides a note which he gave me upon James Paywell, for 143 dols. 90 cts.; how stands the balance between us? *Ans. The balance is* $105.06 *cts. due to me.*

7. Paid A B in full for E F's bill on me, for 105*l.* 10*s.* viz. I gave him Richard Drawer's note for 15*l.* 14*s.* 9*d.* Peter Johnson's do. for 30*l.* 0*s* 6*d.* an order on Robert Dealer for 39*l.* 11*s.* the rest I make up in cash. I want to *know* what sum will make up the deficiency? *Ans.* £20 3*s.* 9*d.*

8. A merchant had six debtors, who together, owed him 2917*l.* 10*s.* 6*d.* A, B, C, D, and E, owed him 1675*l.* 13*s.* 9*d.* of it; what was F's debt? *Ans.* £1241 16*s.* 9*d.*

9. A merchant bought 17C. 2qrs. 14lb. of sugar; of which he sells 9C. 3qrs. 25lb. how much of it remains unsold? *Ans. 7C. 2qrs. 17lb.*

10. From a fashionable piece of cloth which contained 52yds. 2na. a taylor was ordered to take three suits, each 6yds. 2qrs. how much remains of the piece?

Ans. 32yds. 2qrs. 2na.

11. The war between England and America commenced April 19, 1775, and a general peace took place January 20th, 1783; how long did the war continue?

Ans. 7yrs. 9mo. 1d.

COMPOUND MULTIPLICATION.

COMPOUND Multiplication is when the Multiplicand consists of several denominations, &c.

1. *To Multiply Federal Money.*

RULE.

Multiply as in whole numbers, and place the separatrix as many figures from the right hand in the product, as it is in the multiplicand, or given sum.

EXAMPLES.

```
                 $ cts.                          $ d. c. m.
1. Multiply 35  09 by 25.   2. Multiply 49 0 0 5 by 97.
                25                                 97
              -----                          --------
              17545                            343035
              7018                            441045
              -----                          --------
Prod. $877, 25                             $4753, 4 8 5
```

$ cts.

3. Multiply 1 dol. 4 cts. by 305 *Ans.* 317, 20

4. Multiply 41 cts. 5 mills by 150 *Ans.* 62, 25

5. Multiply 9 dollars by 50 *Ans.* 450, 00

6. Multiply 9 cents by 50 *Ans.* 4, 50

7. Multiply 9 mills by 50 *Ans.* 0, 45

8. There were forty-one men concerned in the payment of a sum of money, and each paid 3 dollars and 9 mills; how much was paid in all?

Ans. $123 36*cts.* 9*mills.*

9. The number of inhabitants in the United States is five millions; now suppose each should pay the trifling sum of 5 cents a year, for the term of 12 years, towards a continental tax; how many dollars would be raised thereby?

Ans. three millions Dollars.

2. *To Multiply the Denominations of Sterling Money, Weights, Measures, &c.*

RULE.*

Write down the Multiplicand, and place the quantity underneath the least denomination, for the Multiplier, and in multiplying by it, observe the same rules for carrying from one denomination to another, as in Compound Addition.

INTRODUCTORY EXAMPLES.

£. s. *d.* *q.*
Multiply 1 11 6 2 by 5.
5
Prod. £7 17 8 2

s. *d.*
How much is 3 **times** 11 9
3
£1 15 3

£.	s.	d.	£.	s.	d.	£.	s.	d.
15	10	8	24	12	6	21	15	8
		2			3			4
19	11	10	10	16	4	31	10	9¼
		5			6			7

---

* When accounts are kept in pounds, shillings and pence, this kind of multiplication is a concise and elegant method of finding the value of goods, at so much per yard, lb. &c. the general rule being to multiply the given price by the quantity.

31	16	8	12	17	10	14	10	7½
		8			9			10
32	12	10	6	19	1	26	8	4¼
		11			12			12

Practical Questions.

What cost nine yards of cloth at 5s. 6d. per yard?

£0 5 6 price of one yard.
Multiply by 9 yards.

Ans. £2 9 6 price of nine yards.

QUESTIONS.		£.	s.	d.		ANSWERS. £.	s.	d.
4 gallons of wine,	at	0	8	7	per gallon.	1	14	4
5 C. Malaga Raisins,	at	1	2	3	per cwt.	5	11	3
7 reams of paper,	at	0	17	9½	per ream.	6	4	6½
8 yds. of broadcloth,	at	1	7	9½	per yard.	11	2	4
9 lb. of cinnamon,	at	0	11	4¼	per lb.	5	2	2¼
11 tons of hay,	at	2	1	10	per ton.	23	0	2
12 bushels of apples,	at	0	1	9	per bush.	1	1	0
12 bushels of wheat,	at	0	9	10	per bush.	5	18	0

2. When the multiplier, that is, the quantity, is a composite number, and greater than 12, take any two such numbers as when multiplied together, will exactly produce the given quantity, and multiply first by one of those figures, and that product by the other; and the last product will be the answer.

EXAMPLES.

What cost 28 yards of cloth, at 6s 10d. per yard?

£. s. d.
0 6 10 price of one yard.
Multiply by 7

Produces 2 7 10 price of 7 yards.
Multiply by 4

Answer, £9 11 4 price of 28 yards.

QUESTIONS.				s.	d.	qrs.			ANSWERS. £.	s.	d.
24	yards	at		7	4	3	per yard,	=	8	17	6
27	—	at		9	10	0	—	=	13	5	6
44	—	at		12	4	2	—	=	27	4	6
55	—	at		8	3	1	—	=	22	14	10¾
72	—	at		19	11	0	—	=	71	14	0
20	—	at		3	6	2	—	=	3	10	10
84	—	at		18	4	2	—	=	77	3	6
96	—	at		11	9	0	—	=	56	8	0
63	—	at	£. 1	17	6	0	—	=	118	2	6
144	—	at	1	4	2	0	—	=	174	0	0

3. When no two numbers multiplied together will exactly make the multiplier, you must multiply by any two whose product will come the nearest; then multiply the upper line by what remained; which added to the last product gives the answer.

EXAMPLES.

What will 47 yds. of cloth come to at 17*s*. 9*d*. per yd.?

	£.	s.	d.	
	0	17	9	price of 1 yard.
Multiply by			5	
Produces	4	8	9	price of 5 yards.
Multiply by			9	
Produces	39	18	9	price of 45 yards.
	1	15	6	price of 2 yards.
Answer,	£41	14	3	price of 47 yards.

QUESTIONS.		£.	s.	d.		ANSWERS. £.	s.	d.
23 ells of linen,	at	0	3	6½	per ell.	4	1	5½
17 ells of dowlas,	at	0	1	6½	per ell.	1	6	2½
39 cwt. of sugar,	at	3	10	6	per cwt.	137	9	6
52 yds. of cloth,	at	0	5	9	per yd.	14	19	0
19 lbs. of indigo,	at	0	11	6	per lb.	10	18	6
29 yds. of cambric,	at	0	13	7	per yd.	19	13	11
111 yds. broadcloth,	at	1	2	6	per yd.	124	17	6
94 beaver hats,	at	1	9	4	apiece.	137	17	4

4. To find the value of a hundred weight, by having the price of one pound.

If the price be farthings, multiply 2s. 4d. by the farthings in the price of one lb.—Or, if the price be pence, multiply 9s. 4d. by the pence in the price of one lb. and in either case the product will be the answer.

EXAMPLES.

What will 1 cwt. of rice come to, at 2¼d. per lb.?

s. d.
112 farthings=2 4 price 1 cwt. at ¼d. per lb.
9 farthings in the price of 1 lb.

Ans £1 1 0 price of 1 cwt. at 9¼ per lb.

What will 1 cwt. of lead come to at 7d. per lb.?

s. d.
9 4
7

Ans. £3 5 4

Questions.				*Answers.*		
1 cwt.	at 2½d	per lb.	=	£1	3	4
1 ditto,	at 2¾d	—	=	1	5	8
1 ditto,	at 3d	—	=	1	8	0
1 ditto,	at 2d	—	=	0	18	8
1 ditto,	at 3½d	—	=	1	12	8

* * *

Examples of Weights, Measures, &c.

1. How much is 5 times 7cwt. 3 qrs. 15 lb.?

Cwt. *qrs.* *lb.*
7 3 15
5

Ans. Cwt. 39 1 19

lb. *oz.* *pwt.* *gr.*
2. Multiply 20 2 7 13 by 4.
4

Product lb. 80 9 10 4

cwt. *qr.* *lb.* *oz.*
(3) 27 1 13 12
6

lb. 164 0 26 8

	ANSWERS.
yds. qr. na.	*yds. qr. na.*
4. Multiply 14 3 2 by 11	163 2 2
hhd. g. qt. pt.	*hhd. g. qt. pt.*
5. Multiply 21 15 2 1 by 12	254 61 2 0
le. m. fur. po.	*le. m. fur. po.*
6. Multiply 81 2 6 21 by 8	655 1 4 8
a. r. p.	*a. r. p.*
7. Multiply 41 2 11 by 18	748 0 38
yr. m. w. d.	*yr. m. w. d.*
8. Multiply 20 5 3 6 by 14	286 5 2 0
S. ° ' "	*S.* ° ' "
9. Multiply 1 15 48 24 by 5	7 19 2 0
cds. ft.	*cds. ft.*
10 Multiply 3 87 by 8	29 56

Practical Questions in

WEIGHTS & MEASURES.

1. What is the weight of 7 hhds. of sugar, each weighing 9 cwt. 3 qrs. 12 lb.? *Ans.* 69 *cwt.*

2. What is the weight of 6 chests of tea, each weighing 3 cwt. 2 qrs. 9 lb.? *Ans.* 21*cwt.* 1*qr.* 26*lb.*

3. How much brandy in 9 casks, each containing 41 gals. 3 qts. 1 pt.? *Ans.* 376*gals.* 3*qts.* 1*pt.*

4. In 35 pieces of cloth, each measuring 27¾ yards, how many yards? *Ans.* 971*yds.* 1*qr.*

5. In 9 fields, each containing 14 acres, 1 rood, and 25 poles, how many acres? *Ans.* 129*a.* 2*qrs.* 25*rods.*

6. In 6 parcels of wood, each containing 5 cords and 96 feet, how many cords? *Ans.* 34½*cords.*

7. A gentleman is possessed of 1½ dozen of silver spoons, each weighing 2 oz. 15 pwt. 11 grs. 2 dozen of tea-spoons, each weighing 10 pwt. 14 grs. and 2 silver *tankards, each* 21 oz. 15 pwt. Pray what is the weight *of the whole?* *Ans.* 8lb. 10oz. 2pwt. 6grs.

COMPOUND DIVISION,

TEACHES to find how often one number is contained in another of different denominations.

DIVISION OF FEDERAL MONEY.

☞ Any sum in Federal Money may be divided as a whole number; for, if dollars and cents be written down as a simple number, the whole will be cents; and if the sum consists of dollars only, annex two cyphers to the dollars, and the whole will be cents; hence the following

GENERAL RULE.

Write down the given sum in cents, and divide as in whole numbers; the quotient will be the answer in cents.

Note. If the cents in the given sum are less than 10, you must always place a cypher on their left, or in the ten's place of the cents, before you write them down.

EXAMPLES.

1. Divide 35 dollars 68 cents, by 41.

```
41)3568(87
   328
   ---
    288
    287
    ---
Rem.  1
```

the quotient in cents; and when there is any considerable remainder, you may annex a cypher to it, if you please, and divide it again, and you will have the mills, &c.

2. Divide 21 dollars, 5 cents, by 14

```
14)2105(150
   14
   --
    70
    70
    --
     5
```

cents=1 dol. 50 cts. but to bring cents into dollars, you need only point off two figures to the right hand for cents, and the rest will be dollars, &c.

3. Divide 4 dols. 9 cts. or 409 cts. by 6. *Ans.* 68 *cts.*+

4. Divide 9 dols. 24 cts. by 12. Ans. 77 cts.

5. Divide 97 dols. 43 cts. by 85. *Ans.* $1 14*cts.* 6*m.*
6. Divide 248 dols. 54 cts. by 125.
Ans. 198*cts.* 8*m.*=$1 98*cts.* 8*m.*
7. Divide 24 dols. 65 cts. by 248. *Ans.* 9*cts.* 9*m.*
8. Divide 10 dols. or 1000 cts. by 25. *Ans.* 40*cts.*
9. Divide 125 dols. by 500. *Ans.* 25*cts.*
10. Divide 1 dollar into 33 equal parts. *Ans.* 3*cts.*+

PRACTICAL QUESTIONS.

1. Bought 25lb. of coffee for 5 dollars; what is that a pound? *Ans.* 20*cts.*

2. If 131 yards of Irish linen cost 49 dols. 78 cts. what is that per yard? *Ans.* 38*cts.*

3. If an cwt. of sugar cost 8 dols. 96 cts. what is that per pound? *Ans.* 8*cts.*

4. If 140 reams of paper cost 329 dols. what is that per ream? *Ans.* $2 35*cts.*

5. If a reckoning of 25 dols. 41 cts. be paid equally among 14 persons, what do they pay a piece?
Ans. $1 81½*cts.*

6. If a man's wages are 235 dols. 80 cts. a year, what is that a calendar month? *Ans.* $19 65*cts.*

7. The salary of the President of the United States, is twenty-five thousand dollars a year; what is that a day?
Ans. $68 49*cts.*

2. *To divide the denominations of Sterling Money, Weights, Measures, &c.*

RULE.

Begin with the highest denomination as in simple division; and if any thing remains, find how many of the next lower denomination this remainder is equal to; which add to the next denomination; then divide again, carrying the remainder, if any, as before; and so on, till the whole is finished.

PROOF—The same as in Simple Division.

EXAMPLES.

	£.	s.	d.	qr.			£.	s.	d.
Divide	97	3	12	2 by 5.		8)	27	18	6
Quo't.	£19	8	9	2			£3	9	9¾

		£.	s.	d.				£.	s.	d.
3.	Divide	31	11	6	by	2	*Ans.*	15	15	9
4.	Divide	22	3	9	by	3		7	7	11
5.	Divide	70	10	4	by	4		17	12	7
6.	Divide	56	11	5½	by	5		11	6	3½
7.	Divide	61	14	8	by	6		10	5	9¼
8.	Divide	24	15	6½	by	7		3	10	9½
9.	Divide	185	17	6	by	8		23	4	8¼
10.	Divide	182	16	8	by	9		20	6	3½
11.	Divide	16	1	11	by	10		1	12	2¼
12.	Divide	1	19	8	by	11		0	3	7¼
13.	Divide	6	6	6	by	12		0	10	6½
14.	Divide	1	2	6	by	9		0	2	6
15.	Divide	948	11	6	by	12		79	0	11½

2. When the divisor exceeds 12, and is the product of two or more numbers in the table multiplied together.

RULE.

Divide by one of those numbers first, and the quotient by the other, and the last quotient will be the answer.

EXAMPLES.

		£.	s.	d.				£.	s.	d.
1.	Divide	29	15	0	by	21	*Ans.*	1	8	4
2.	Divide	27	16	0	by	32		0	17	4½
3.	Divide	67	9	4	by	44		1	10	8
4.	Divide	24	16	6	by	36		0	13	9½
5.	Divide	128	9	0	by	42		3	1	2
6.	Divide	269	12	4	by	56		4	16	3½
7.	Divide	248	10	8	by	64		3	17	8
8.	Divide	65	14	0	by	72		0	18	3
9.	Divide	5	10	3	by	81		0	1	4¼

	£.	s.	d.			£.	s.	d.
10. Divide	115	10	0	by	90	1	5	8
11. Divide	136	16	6	by	108	1	5	4
12. Divide	202	13	6	by	121	1	13	6
13. Divide	34	4	0	by	144	0	4	9

3. When the divisor is large, and not a composite number, you may divide by the whole divisor at once, after manner of long division, as follows, viz.

EXAMPLES.

Divide 128*l.* 13*s.* 3*d*, by 47.

£. s. d. £. s. d.
47)128 13 3(2 14 9 quotient.
94
34 pounds remaining.
Multiply by 20 and add in the 13s.
produces 693 shillings, which divided by 47, gives
47 [14s. in the quotient.
223
188
35 shillings remaining.
Multiply by 12 and add in the 3d.
produces 423 pence, which divided as above, gives
423 [9d. in the quotient

	£.	s.	d.				£.	s.	d.
2. Divide	113	13	4	by	31.	*Ans.*	3	13	4
3. Divide	85	6	3	by	75.		1	2	9
4. Divide	315	3	10¼	by	365.		0	17	3¼
5. Divide	132	0	6	by	68.		1	18	10
6. Divide	740	16	8	by	100.		7	8	2
7. Divide	888	18	10	by	95.		9	7	1¾

EXAMPLES OF
WEIGHTS, MEASURES, &c.

1. Divide 14 cwt. 1 qr. 8 lb. of sugar equally among 8 men.

	C.	*qr.*	*lb.*	*oz.*	
8)	14	1	8	0	
	1	3	4	8	Quotient.
				8	
	14	1	8	0	Proof.

2. Divide 6 T. 11 cwt. 3 qrs. 19 lb. by 4
Ans. 1*T.* 12*cwt.* 3*qrs.* 25*lb.* 12*oz.*

3. Divide 14 cwt. 1 qr. 12 lb. by 5
Ans. 2*cwt.* 3*qrs.* 13*lb.* 9*oz.* 9*dr.*+

4. Divide 16 lb. 13 oz. 10 dr. by 6
Ans. 2*lb.* 12*oz.* 15*dr.*

5. Divide 56 lb. 6 oz. 17 pwt. of silver into 9 equal parts. *Ans.* 6*lb.* 3*oz.* 8*pwt.* 13*grs.*+

6. Divide 26 lb. 1 oz. 5 pwt. by 24
Ans. 1*lb.* 1*oz.* 1*pwt.* 1*gr.*

7. Divide 9 hhds. 28 gals. 2 qts. by 12
Ans. 0*hhds.* 49*gals.* 2*qts.* 1*pt.*

8. Divide 168 bu. 1 pk. 6 qts. by 35
Ans. 4*bu.* 3*pks.* 2*qts.*

9. Divide 17 lea. 1 m. 4 fur. 21 po. by 21
Ans. 2*m.* 4*fur.* 1*po.*

10. Divide 43 yds. 1 qr. 1 na. by 11
Ans. 3*yds.* 3*qrs.* 3*na.*

11. Divide 97 E. E. 4 qrs. 1 na. by 5
Ans. 19*yds.* 2*qrs.* 3*na.*+

12. Divide 4½ gallons of brandy equally among 144 soldiers. *Ans.* 1*gill a-piece.*

13. Bought a dozen of silver spoons, which together weighed 3lb. 2 oz. 13 pwt. 12 grs. how much silver did each spoon contain? *Ans.* 3*oz.* 4*pwt.* 11*gr.*

14. Bought 17 cwt. 3 qrs. 19 lb. of sugar, and sold out one third of it; how much remains unsold?
Ans. 11*cwt.* 3*qrs.* 22*lb.*

15. From a piece of cloth containing 64 yards 2 na. a taylor was ordered to make 9 soldiers' coats, which took one third of the whole piece; how many yards did each coat contain? *Ans.* 2*yds.* 1*qr.* 2*na.*

PRACTICAL QUESTIONS.

1. If 9 yards of cloth cost 4*l.* 3*s.* 7½*d.* what is that per yard?

	£.	*s.*	*d.*	*qr.*	
9)	4	3	7	2	
		9	3	2	*Answer.*

2. If 11 tons of hay cost 23*l.* 0*s.* 2*d.* what is that per ton? *Ans.* £2 1*s.* 10*d.*

3. If 12 gallons of brandy cost 4*l.* 15*s.* 6*d.* what is that per gallon? *Ans.* 7*s.* 11*d.* 2*qrs.*

4. If 84 lbs. of cheese cost 1*l.* 16*s.* 9*d.* what is that per pound? *Ans.* 5¼*d.*

5. Bought 48 pairs of stockings for 11*l.* 2*s.* how much a pair do they stand me in? *Ans.* 4*s.* 7½*d.*

6. If a reckoning of 5*l.* 8*s.* 10½*d.* be paid equally among 13 persons what do they pay a-piece? *Ans.* 8*s.* 4½*d.*

7. A piece of cloth containing 24 yards, cost 18*l.* 6*s.* what did it cost per yard? *Ans.* 15*s.* 3*d.*

8. If a hogshead of wine cost 33*l.* 12*s.* what is it a gallon? *Ans.* 10*s.* 8*d.*

9. If 1 cwt. of sugar cost 3*l.* 10*s.* what is it per pound? *Ans.* 7½*d.*

10. If a man spends 71*l.* 14*s.* 6*d.* a year what is that per calendar month? *Ans.* £5 19*s.* 6½*d.*

11. The Prince of Wales' salary is 150,000*l.* a year, what is that a day? *Ans.* £410 19*s.* 2*d.*

12. A privateer takes a prize worth 12465 dollars, of which the owner takes one half, the officers one fourth, and the remainder is equally divided among the sailors, *who are 125 in number*; how much is each sailor's part? *Ans.* $24 93cts.

13. Three merchants, A, B, and C, have a ship in company. A hath $\frac{5}{8}$, B $\frac{2}{8}$, and C $\frac{1}{8}$, and they receive for freight 228*l.* 16*s.* 8*d.* It is required to divide it among the owners according to their respective shares.

Ans. A's share £143 0s. 5d. B's share £57 4s. 2d. C's share £28 12s. 1d.

14. A privateer having taken a prize worth $6850, it is divided into one hundred shares; of which the captain is to have 11; 2 lieutenants, each 5; 12 midshipmen, each 2; and the remainder is to be divided equally among the sailors, who are 105 in number.

Ans. Captain's share $753 50cts. lieut's. $342 50cts. a midshipman's $137, and a sailor's $35 88cts.

REDUCTION,

TEACHES to bring or change numbers from one name to another, without altering their value.

Reduction is either Descending or Ascending.

Descending is when great names are brought into small, as pounds into shillings, days into hours, &c.—This is done by Multiplication.

Ascending is when small names are brought into great, as shillings into pounds, hours into days, &c. This is performed by Division.

REDUCTION DESCENDING.

RULE.

Multiply the highest denomination given, by so many of the next less as make one of that greater, and thus continue till you have brought it down as low as your question requires.

Proof. Change the order of the question, and divide your last product by the last multiplier, and so on.

EXAMPLES.

1. *In 25l. 15s. 9d. 2qrs.* how many farthings?

£.	s.	d.	qrs.
25	15	9	2

20

515 shillings.
12

6189 pence.
4

24758 farthings.

Proof.

4)24758 *Ans.* 24758

12)6189 2 qrs.

2|0)51|5 9d.

£25 15 9½

Note. In multiplying by 20, I added in the 15s.—by 12 the 9d.—and by 4 the 2qrs. which must always be done in like cases.

2. In 31*l.* 11s. 10*d.* 1*qr.* how many farthings? *Ans.* 303[illegible]9

3. In 46*l.* 5*s.* 11*d.* 3*qrs.* how many farthings? *Ans.* 44447

4. In 61*l.* 12*s.* how many shillings, pence and farthings? *Ans.* 1232*s.* 14784*d.* 59136*qrs.*

5. In 84*l.* how many shillings and pence? *Ans.* 1680*s.* 20160*d.*

6. In 18*s.* 9*d.* how many pence and farthings? *Ans.* 225*d.* 900*qrs.*

7. In 312*l.* 8*s.* 5*d.* how many half-pence? *Ans.* 149962

8. In 846 dollars at 6*s.* each, how many farthings? *Ans.* 243648

9. In 41 guineas at 28s. each, how many pence? *Ans.* 13776

10. In 59 pistoles, at 22*s.* how many shillings, pence, and farthings? *Ans.* 1298*s.* 15576*d.* 62304*qrs.*

11. In 37 half-johannes, at 48*s.* how many shillings, six-pences, and three-pences? *Ans.* 1776*s.* 3552 *six-pences.* 7104 *three-pences.*

12. In 121 French crowns, at 6*s.* 8*d.* each, how many pence and farthings? *Ans.* 9680*d.* 38720*qrs.*

REDUCTION ASCENDING.

RULE.

Divide the lowest denomination given, by so many of that name as make one of the next higher, and so on through all the denominations, as far as your question requires.

Proof. Multiply inversely by the several divisors.

EXAMPLES.

1. In 224765 farthings, how many pence, shillings and pounds?

Farthings in a penny = 4)224765

Pence in a shilling = 12)56191 1

Shillings in a pound = 2|0)468|2 7d.

£234 2s. 7d. 1qr.

Ans. 56191*d.* 4682*s.* 234*l.*

Note. The remainder is always of the same name as the dividend.

2. Bring 30329 farthings into pounds?
Ans. £31 11*s.* 10*d.* 1*qr.*

3. In 44447 farthings, how many pounds?
Ans. £46 5*s.* 11*d.* 3*qrs.*

4. In 59136 farthings, how many pence, shillings, and pounds? *Ans.* 14784*d.* 1232*s.* £61 12*s.*

5. In 20160 pence, how many shillings and pounds?
Ans. 1680*s.* or £84.

6. In 900 farthings, how many pounds?
Ans. £0 18*s.* 9*d.*

7. Bring 74981 half-pence into pounds?
Ans. £156 4*s.* 2½*d.*

8. In 243648 farthings, how many dollars at 6s. each?
Ans. $846.

9. Reduce 13776 pence to guineas, at 28s. per guinea.
Ans. 41

10. In 62304 farthings, how many pistoles, at 22s. each? *Ans.* 59.

11. In 7104 three-pences, how many half-johannes, at 48s.? *Ans.* 37.

12. In 38720 farthings, how many French crowns, at 6s. 8d.? *Ans.* 121.

Reduction Ascending and Descending.

1. MONEY.

1. In 121*l.* 0s. 9½d. how many half-pence?
Ans. 58099.

2. In 58099 half-pence, how many pounds?
Ans. 121*l.* 0s. 9½*d.*

3. Bring 23760 half-pence into pounds. *Ans.* £49 10s.

4. In 214*l.* 1s. 3d. how many shillings, six-pences, three pences, and farthings? *Ans.* 4281s. 8562 *six-pences,* 17125 *three-pences, and* 205500 *farthings.*

5. In 137*l.* how many pence, and English or French crowns at 6s. 8d. each? *Ans.* 32880*d.* 411 *crowns.*

6. In 249 English half-crowns, how many pence and pounds? *Ans.* 9960*d. and* £41 10*s.*

7. In 346 guineas, at 21s. each, how many shillings, groats and pence? *Ans.* 7266s. 21798 *gr'ts and* 87192*d.*

8. In 48 guineas, at 28s. each, how many 4½d. pieces?
Ans. 3584

9. In 81 guineas, at 27s. 4d. each how many pounds?
Ans. £110 14s.

10. In 24396 pence, how many shillings, pounds and pistoles? *Ans.* 2033*s,* £101 13*s. and* 92 *pistoles.*
9s. *over.*

11. In 252 moidores, at 36s. each, how many guineas at 28s. each? *Ans.* 324.

12. In 1680 Dutch guilders, at 2s. 4d. each, how many pistoles at 22s. each? *Ans.* 178 *pistoles,* 4s.

13. Borrowed 1248 English crowns, at 6s. 8d. each, how many pistareens, at 14½d. each will pay the debt?
Ans. 6885 *pistareens and* 7½*d.*

14. In 50*l.* how many shillings, nine-pences, six-pences, four-pences, and pence, and of each an equal number?
12*d.*+9*d.*+6*d.*+4*d.*+1*d.* =32*d.* and £50 =
12000d.÷32=375 *Ans.*

EXAMPLES IN

REDUCTION OF FEDERAL MONEY.

1. Reduce 2745 dollars into cents.

2745 dollars
100
———
Ans. 274500
———

Here I multiply by 100, the cents in a dollar; but dollars are readily brought into cents by annexing two cyphers, and into mills by annexing three cyphers. Also, any sum in Federal money may be written down as a whole number and expressed in its lowest denomination; for, when dollars and cents are joined together as a whole number, without a separatrix, they will shew how many cents the given sum contains; and when dollars, cents, and mills are so joined together, they will shew the whole number of mills in the given sum.—Hence, properly speaking, there is no reduction of this money; for cents are readily turned into dollars by cutting off the two right hand figures, and mills by pointing off three figures with a dot; the figures to the left hand of the dot, are dollars; and the figures cut off are cents, or cents and mills.

2. In 345 dollars, how many cents and mills?
Ans. 34500*cts.* 345000 *mills.*
3. Reduce 48 dols. 78 cts. into cents. *Ans.* 4878
4. Reduce 25 dols. 8 cts. into cents. *Ans.* 2508
5. Reduce 54 dols. 36 cts. 5m. into mills. *Ans.* 54365
6. Reduce 9 dols. 9 cts. 9m. into mills. *Ans.* 9099

$ *cts.*
7. Reduce 41925 cents into dollars. *Ans.* 419 25
8. Change 4896 cents into dollars. 48 96
9. Change 45009 cents into dollars. 450 09
10. Bring 4625 mills into dollars. 4 62 5

* * *

2. TROY WEIGHT.

1. How many grains in a silver tankard, that weighs 10lb. 11 oz. 15 pwt.?

lb. oz. pwt.
1 11 15
12 ounces in a pound.
—
23 ounces.
20 pennyweights in one ounce.
—
475 pennyweights.
24 grains in one pennyweight.
—
1900
950
—
Proof. 24)11400 grains. *Ans.*
2,0)47,5
12)23 15 pwt.
1 lb. 11 oz. 15 pwt.

2. In 246 oz. how many pwts. and grains? *Ans.* 4920*pwt.* 118080*grs.*

3. Bring 46080 grs. into pounds. *Ans.* 8

4. In 97397 grains of gold how many pounds? *Ans.* 16*lb.* 10*oz.* 18*pwt.* 5*grs.*

5. In 15 ingots of gold, each weighing 9 oz. 5 pwt. how many grains? *Ans.* 66600

6. In 4 lb. 1 oz. 1 pwt. of silver, how many table spoons, weighing 23 pwt. each, and tea-spoons, 4 pwt. 6 grs. each, can be made, and an equal number of each sort?

23*pwt.*+4*pwt.* 6*grs.*=654*grs. the divisor;* and 4*lb.* 1*oz.* 1*pwt.*=23544*grs. the dividend.* Therefore 23544 ÷654=36 *Answer.*

* * *

3. AVOIRDUPOIS WEIGHT.

In 89 cwt. 3 qrs. 14 lb. 12 oz. how many ounces?
4
—
359 quarters.

[Carried up.]

359 quarters.
28

2876
719

10066 pounds.
16

60398
10067

161068 ounces. *Answer.*

Proof.
16)161068

28)10066 12*oz.*

4)359 14*lb.*

89*cwt.* 3*qrs.* 14*lb.* 12*oz.*

2. In 19 lb. 14 oz. 11 dr. how many drams? *Ans.* 5099.

3. In 1 ton, how many drams? *Ans.* 573440.

4. In 24 tons, 17 cwt. 3 qrs. 17 lb. 5 oz. how many ounces? *Ans.* 892245.

5. Bring 5099 drams into pounds. *Ans.* 19*lb.* 14*oz.* 11*dr.*

6. Bring 573440 drams into tons. *Ans.* 1.

7. Bring 892245 ounces into tons. *Ans.* 24 *tons*, 17*cwt.* 3*qrs.* 17*lb.* 5*oz.*

8. In 12 hhds. of sugar, each 11 cwt. 25 lb. how many pounds? *Ans.* 15084.

9. In 42 pigs of lead, each weighing 4cwt. 3qrs. how many fothers at 19cwt. 2qrs.? *Ans.* 10 *fother*, 4½*cwt.*

10. A gentleman has 20 hhds. of tobacco, each 8 cwt. 3qrs. 14lb. and wishes to put it into boxes containing 70 lb. each, I demand the number of boxes he must get? *Ans.* 284.

* * *

4. APOTHECARIES' WEIGHT.

1. In 9℔ 8℥ 1ʒ 2℈ 19grs. how many grains. *Ans.* 55799.

2. In 55799 grains, how many pounds? *Ans.* 9℔ 8℥ 1ʒ 2℈ 19gr.

5. CLOTH MEASURE.

1. In 95 yards, how many quarters and nails?
Ans. 380*qrs.* 1520*na.*

2. In 341 yards, 3qrs. 1na. how many nails?
Ans. 5469.

3. In 3783 nails, how many yards?
Ans. 236*yds.* 1*qr.* 3*na.*

4. In 61 Ells English, how many quarters and nails?
Ans. 305*qrs.* 1220*na.*

5. In 56 Ells Flemish, how many quarters and nails?
Ans. 168*qrs.* 672*na.*

6. In 148 Ells English, how many Ells Flemish?
Ans. 246*E. F.* 2*qrs.*

7. In 1920 nails, how many yards, Ells Flemish, and Ells English?
Ans. 120*yds.* 160*E. F. and* 96*E. E.*

8. How many coats can be made out of 36¾ yards of broadcloth, allowing 1¾ yards to a coat? *Ans.* 21.

* * *

6. DRY MEASURE.

1. In 136 bushels, how many pecks, quarts and pints?
Ans. 544*pks.* 4352*qts.* 8704*pts.*

2. In 49 bush. 3pks. 5qts. how many quarts?
Ans. 1597.

3. In 8704 pints, how many bushels? *Ans.* 136.

4. In 1597 quarts, how many bushels?
Ans. 49*bus.* 3*pks.* 5*qts.*

5. A man would ship 720 bushels of corn in barrels, which will hold 3 bushels, 3 pecks each, how many barrels must he get? *Ans.* 192.

* * *

7. WINE MEASURE.

1. In 9 tuns of wine, how many hogsheads, gallons and quarts?
Ans. 36*hhds.* 2268*gal.* 9072*qts.*

2. In 24 hhds. 18 gals. 2 qts. how many pints?
Ans. 12244.

3. In 9072 quarts, how many tuns? *Ans.* 9.

4. In 1905 pints of wine, how many hogsheads?
Ans. 3hhds. 49gals. 1pt.

5. In 1789 quarts of cider, how many barrels? *Ans.* 14*bls.* 25*qts.*

6. What number of bottles, containing a pint and a half each, can be filled with a barrel of cider? *Ans.* 168.

7. How many pints, quarts, and two quarts, each an equal number, may be filled from a pipe of wine? *Ans.* 14[illegible]

* * *

8. LONG MEASURE.

1. In 51 miles, how many furlongs and poles? *Ans.* 408*fur.* 16320*poles.*

2. In 49 yards, how many feet, inches, and barley-corns? *Ans.* 147*ft.* 1764*inch.* 5292*b.c.*

3. How many inches from Boston to New-York, it being 248 miles? *Ans.* 15713280*inch.*

4. In 4352 inches, how many yards? *Ans.* 120*yds.* 2*ft.* 8*in.*

5. In 682 yards, how many rod[illegible] *Ans.* 682×2÷11=124*rods.*

6. In 15840 yards, how [illegible]ny miles and leagues? *Ans.* 9*m.* 3*lea.*

7. How ma[illegible] times will [illegible]ge wheel, 16 feet and 9 inches in[illegible]erence, turn round in going from New-York to [illegible]phia; it being 96 miles? *Ans.* 30261 *times, and* 8¼ *feet over.*

8. How many barley-corns will reach [illegible]nd the globe, it being 360 degrees? *Ans.* [illegible]755801600.

* * *

9. LAND OR SQUARE MEASURE.

1. In 241 acres, 3 roods and 25 poles, how many square rods or perches? *Ans.* 38705*perches.*

2. In 20692 square poles, how many acres? *Ans.* 129*a.* 1*r.* 12*po.*

3. If a piece of land contain 24 acres, and an inclosure of 17 acres, 3 roods, and 20 rods be taken out of it, how many perches are there in the remainder? *An*[illegible]80 *perches.*

4. Three fields contain, the first 7 acres, the second 10 acres, the third 12 acres, 1 rood; how many shares can they be divided into, each share to contain 76 rods? *Ans.* 61 *shares, and* 44 *rods over.*

10. SOLID MEASURE.

1. In 14 tons of hewn timber, how many solid inches? *Ans.* 14×50×1728=1209600.

2. In 19 tons of round timber, how many inches? *Ans.* 1313280.

3. In 21 cords of wood, how many solid feet? *Ans.* 21×128=2688.

4. In [illegible] cords of wood, how many solid feet and inches? *Ans.* 1536*ft.* and 2654208*inch.*

5. In 4608 solid feet of wood, how many cords? *Ans.* 36*cds.*

11. TIME.

1. In [illegible] weeks, how many days, hours, minutes, and seconds?
Ans. 287*d.* 6888*h.* 413280*min.* and 24796800*sec.*

2. In 214d. 15h. 31m. 25sec. how many seconds? *Ans.* 18545485*sec.*

3. In 24796800 seconds, how many weeks? *Ans.* 41 *weeks.*

4. In 1[illegible]4009 minutes, how many days? *Ans.* 127*d.* 18*h.* 49*min.*

5. How many days [illegible] the birth of Christ, to Christmas, 1797, allowing the year to c[illegible]5 days, 6 hours, *Ans.* 656354*d.* 6*h.*

6. Suppose your age to be 16 years and 20 days, how many seconds old are you, allowing 365 days and 6 hours to the year? *Ans.* 506649600*sec.*

7. From March 2d, to November 19th following, inclusive, how many days? *Ans.* 262.

12. CIRCULAR MOTION.

1. In 7 signs, 15° 24′ 40″ how many degrees, minutes, and seconds? *Ans.* 225° 13524′ and 811480″

2. Bring 1020300 seconds into signs. *Ans.* 9 *signs,* 13° 25′

QUESTIONS TO EXERCISE REDUCTION.

1. In 1259 groats, how many farthings, pence, shillings, and guineas at 28s. *Ans.* 20144*qrs.* 5036*d.* 419*s.* 8*d.* and 14*guineas,* 27*s.* 8*d.*

2. Borrowed 10 English guineas at 28s. each, and 24 English crowns at 6s. and 8d. each; how many pistoles at 22s. each will pay the debt? *Ans.* 20.

3. Four men brought each 17*l.* 10s. sterling value in gold into the mint, how many guineas at 21s. each must they receive in return? *Ans.* 66 *guin.* 14s.

4. A silversmith received three ingots of silver, each weighing 27 ounces, with directions to m[illegible]hem into spoons of 2 oz. cups of 5 oz. salts of 1 oz. and snuff boxes of 2 oz. and deliver an equal number of each; what was the number? *Ans.* 8 *of each, and* 1 *oz. over.*

5. Admit a ship's cargo from Bordeaux to be 250 pipes, 180 hhds. and 150 quarter casks [½ hhds.] how many gallons in all; allowing every pint to be a pound, what burden was the ship of? *Ans.* 44415 *gals. and the ship's burden was* 158 *tons,* 12*cwt.* 2*qrs.*

6. In 15 pieces of cloth, each piece 20 yds. how many French Ells? *Ans.* 200.

7. In 10 bales of cloth, each bale 12 pieces, and each piece 25 Flemish Ells, how many yards? *Ans.* 2250.

8. The forward wheels of a waggon are 14½ feet in circumference, and the hind w[illegible]5 feet 9 inches, how many more tim[illegible]e forward wheels turn round than the hind wheel[illegible]ning from Boston to New-York, it being 248 miles? *Ans.* 7167.

9. How many times will a ship 97 feet [illegible]ches long, sail her length in the distance of 12800 leagues and ten yards? *Ans.* 2079508.

10. The sun is 95,000,000 of miles from the earth, and a cannon ball at its first discharge flies about a mile in 7½ seconds; how long would a cannon ball be, at that rate in flying from here to the sun?

Ans. 22*yr.* 216*d.* 12*h.* 40*m.*

11. The Sun travels through 6 signs of the Zodiac in half a year; how many degrees, minutes and seconds?

Ans. 180*deg.* 10800*min.* 648000*sec.*

12. How many strokes does a regular [illegible]k strike in 365 days, or a year? *Ans.* 56940.

13. How long will it take to count a million at the rate of 50 a minute? *Ans.* 333*h.* 20*m.* or 13*d.* 21*h.* 20*m.*

14. The national debt of England amounts to about 279 millions of pounds sterling; how long would it take to count this debt in dollars (4s. 6d. sterling) reckoning without intermission twelve hours a day at the rate of 50 dollars a minute, and 365 days to the year?

Ans. 94 *years*, 134 *days*, 5 *hours*, 20 *min.*

FRACTIONS.

FRACTIONS, or broken numbers, are expressions for any assignable part of an unit or whole number, and (in general) are of two kinds, viz.

VULGAR AND DECIMAL.

A *Vulgar Fraction*, is represented by two numbers placed one above another, with a line drawn between them, thus, $\frac{3}{4}$, $\frac{5}{8}$, &c. signifies three-fourths, five-eights, &c.

The figure above the line, is called the numerator, and that below it, the denominator,

Thus, $\left\{\begin{array}{l} 5 \text{ Numerator.} \\ \overline{8} \text{ Denominator.} \end{array}\right.$

The denominator (which is the divisor in division) shews how many parts the integer is divided into; and the numerator (which is the remainder after division) shews how many of those parts are meant by the fraction.

A fraction is said to be in its least or lowest terms, when it is expressed by the least numbers possible, as $\frac{4}{8}$ when reduced to its lowest terms will be $\frac{1}{2}$, and $\frac{9}{12}$ is equal to $\frac{3}{4}$, &c.

PROBLEM I.

To abbreviate or reduce fractions to their lowest terms.

RULE.

Divide th[illegible]erms of the given fraction by any number which will divide them without a remainder, and the quotients again in the same manner; and so on, till it appears that there is no number greater than 1, which will divide them, and the fraction will be in its least terms

EXAMPLES.

1. Reduce $\frac{144}{240}$ to its lowest terms.

(3) (2)
8)$\frac{144}{240}=\frac{18}{30}=\frac{6}{10}=\frac{3}{5}$ the Answer.

2. Reduce $\frac{162}{324}$ to its lowest terms. *Ans.* $\frac{1}{2}$
3. Reduce $\frac{216}{288}$ to its lowest terms. *Ans.* $\frac{3}{4}$
4. Reduce $\frac{45}{315}$ to its lowest terms. *Ans.* $\frac{1}{7}$
5. Abbreviate $\frac{66}{72}$ as much as possible. *Ans.* $\frac{11}{12}$
6. Reduce $\frac{825}{960}$ to its lowest terms. *Ans.* $\frac{55}{64}$
7. Reduce $\frac{144}{216}$ to its lowest terms. *Ans.* $\frac{2}{3}$
8. Reduce $\frac{27}{216}$ to its lowest terms. *Ans.* $\frac{1}{8}$
9. Reduce $\frac{171}{180}$ to its lowest terms. *Ans.* $\frac{19}{20}$
10. Reduce $\frac{5184}{6912}$ to its lowest terms. *Aus.* $\frac{3}{4}$

PROBLEM II.

To find the value of a fraction in the known parts of the integer, as to coin, weight, measure, &c.

RULE.

Multiply the numerator by the common parts of the integer, and divide by the denominator, &c.

EXAMPLES.

What is the value of $\frac{2}{3}$ of a pound sterling?

Numer. 2
20 shillings in a pound.
—
Denom. 3)40(13*s.* 4*d.* Ans.
3
—
10
9
—
1
12
—
3)12(4
12

2. What is the value of $\frac{12}{13}$ of a pound sterling?
Ans. 18*s.* 5*d.* $2\frac{2}{13}$*qrs.*
3. Reduce $\frac{3}{8}$ of a shilling to its proper quantity.
Ans. 4½*d.*
4. What is the value of $\frac{3}{8}$ of a shilling? Ans. 4½d.
5. *What is value* of $\frac{12}{16}$ of a pound troy? Ans. 9oz.

6. How much is $\frac{9}{11}$ of an hundred weight?
Ans. 3*qrs.* 7*lb.* 10$\frac{2}{11}$*oz.*

7. What is the value of $\frac{5}{6}$ of a mile?
Ans. 6*fur.* 26*po.* 11*ft.*

8. How much is $\frac{7}{9}$ of an cwt.?
Ans. 3*qrs.* 3*lb.* 1*oz.* 12$\frac{4}{9}$*dr.*

9. Reduce $\frac{5}{9}$ of an Ell English to its proper quantity.
Ans. 2*qrs.* 3$\frac{1}{9}$*na.*

10. How much is $\frac{6}{7}$ of a hhd. of wine? *Ans.* 54*gal.*

11. What is the value of $\frac{9}{13}$ of a day?
Ans. 16*h.* 36*min.* 55$\frac{5}{13}$*sec.*

PROBLEM III.

To reduce any given quantity to the fraction of any greater denomination of the same kind.

RULE.

Reduce the given quantity to the lowest term mentioned for a numerator; then reduce the integral part to the same term, for a denominator; which will be the fraction required.

EXAMPLES.

1. Reduce 13s. 6d. 2qrs. to the fraction of a pound.

20 Integral part — 13 6 2 given sum.
12 12
—— ——
240 162
4 4
—— ——
960 Denominator. 650 Num. *Ans.* $\frac{650}{960}=\frac{65}{96}$£.

2. What part of an hundred weight is 3qrs. 14lb.?
3*qrs.* 14*lb.*=98*lb.* *Ans.* $\frac{98}{112}=\frac{7}{8}$

3. What part of a yard is 3qrs. 3na.? *Ans.* $\frac{15}{16}$

4. What part of a pound sterling is 13s. 4d.? *Ans.* $\frac{2}{3}$

5. What part of a civil year is 3 weeks, 4 days?
Ans. $\frac{25}{365}=\frac{5}{73}$

6. What part of a mile is 6fur. 26po. 3yds. 2ft.?
fur. po. yd. ft. feet.
6 26 3 2=4400 Num.
a mile =5280 Denom. *Ans.* $\frac{4400}{5280}=\frac{5}{6}$

7. Reduce 7oz. 4pwt. to the fraction of a pound troy.
Ans. $\frac{3}{5}$

8. What part of an acre is 2 roods, 20 poles? *Ans.* $\frac{5}{8}$

9. Reduce 54 gallons to the fraction of a hogshead of wine. *Ans.* $\frac{6}{7}$

10. What part of a hogshead is 9 gallons? *Ans.* $\frac{1}{7}$

11. What part of a pound troy is 10oz. 10pwt. 10grs.? *Ans.* $\frac{505}{576}$

DECIMAL FRACTIONS.

A *Decimal Fraction* is that whose denominator is an unit, with a cypher, or cyphers annexed to it, Thus, $\frac{5}{10}$, $\frac{5}{100}$, $\frac{45}{1000}$, &c. &c.

The integer is always divided either into 10, 100, 1000, &c. equal parts; consequently the denominator of the fraction will always, be either 10, 100, 1000, or 10000, &c. which being understood, need not be expressed; for the true value of the fraction may be expressed by writing the numerator only with a point before it on the left hand thus, $\frac{5}{10}$, is written ,5; $\frac{45}{100}$,45; $\frac{725}{1000}$,725, &c.

But if the numerator has not so many places as the denominator has cyphers, put so many cyphers before it, viz. at the left hand, as will make up the defect; so write $\frac{5}{100}$ thus, ,05; and $\frac{6}{1000}$ thus, ,006, &c.

Note. The point prefixed is called the separatrix.

Decimals are counted from the left towards the right hand, and each figure takes its value by its distance from the unit's place: if it be in the first place after units, (or separating point) it signifies tenths; if in the second, hundredths, &c. decreasing in each place in a tenfold proportion, as in the following

NUMERATION TABLE.

Millions.	C. Thousands.	X. Thousands.	Thousands.	Hundreds.	Tens.	Units.	Tenth parts.	Hundredth parts.	Thousandth parts.	X. Thousandth parts.	C. Thousandth parts.	Millionth parts.
7	6	5	4	3	2	1	2	3	4	5	6	7
Whole Numbers.							Decimals.					

Cyphers placed at the right hand of a decimal fraction do not alter its value, since every significant figure continues to possess the same place: so ,5 ,50 and ,500 are all the same value, and equal to $\frac{5}{10}$ or $\frac{1}{2}$.

But cyphers placed at the left hand of decimals, decrease their value in a tenfold proportion, by removing them further from the decimal point. Thus, ,5 ,05 ,005, &c. are five tenth parts, five hundredth parts, five thousandth parts, &c. respectively. It is therefore evident that the magnitude of a decimal fraction, compared with another, does not depend upon the number of its figures, but upon the value of its first left hand figure: for instance, a fraction beginning with any figure less than ,9 such as ,899229, &c. if extended to an infinite number of figures, will not equal ,9.

ADDITION OF DECIMALS.

RULE.

1. Place the numbers, whether mixed or pure decimals, under each other, according to the value of their places.

2. Find their sum as in whole numbers, and point off so many places for the decimals, as are equal to the greatest number of decimal parts in any of the given numbers.

EXAMPLES.

1. Find the sum of 41,653+36,05+24,009+1,6

Thus,
41,653
36,05
24,009
1,6

Sum, 103,312 which is 103 integers, and $\frac{312}{1000}$ parts of an unit. Or, it is 103 units, and 3 tenth parts, 1 hundredth part, and 2 thousandth parts of an unit, or 1.

Hence we may observe, that decimals, and **Federal Money**, are subject to one, and the same law of notation, *and consequently* of operation.

For since dollar is the money unit; and a dime being the tenth, a cent the hundredth, and a mill the thousandth part of a dollar, or unit, it is evident that any number of dollars, dimes, cents and mills, is simply the expression of dollars, and decimal parts of a dollar: Thus, 11 dollars, 6 dimes, 5 cents,=11,65 or 11$\frac{65}{100}$ dol. &c.

2. Add the following mixed numbers together.

(2)	(3)	(4)
Yards.	*Ounces.*	*Dollars.*
46,23456	12,3456	43,9108
24,90400	7,891	1,8191
17,00411	2,34	3,1060
3,01111	5,6	,7012

5. Add the following sums of Dollars together, viz.
$12,34565+7,891+2,34+14,+,0011
Ans. $36,57775, *or* $36, 5*di.* 7*cts.* 7$\frac{75}{100}$*mills.*

6. Add the following parts of an acre together, viz.
,7569+,25+,654+,199
Ans. 1,8599 *acres.*

7. Add 72,5+32,071+2,1574+371,4+2,75
Ans. 480,8784

8. Add 30,07+200,71+59,4+3207,1
Ans. 3497,28

9. Add 71,467+27,94+16,084+98,009+86,5
Ans. 300

10. Add ,7509+,0074+,69+,8408+,6109
Ans. 2,9

11. Add ,6+,099+,37+,905+,026 *Ans.* 2

12. To 9,999999 add one millionth part of an unit and the sum will be 10.

13. Find the sum of
Twenty-five hundredths, - - - - - - -
Three hundred and sixty-five thousandths,
Six tenths, and nine millionths, - - - - -

Answer, 1,2150

SUBTRACTION OF DECIMALS.

RULE.

Place the numbers according to their value; then subtract as in whole numbers, and point off the decimals as in Addition.

EXAMPLES.

	Dollars.			*Inches.*
1. From	125,64		2. From	14,674
Take	95,58756		Take	5,91

3. From	761,8109	719,10009	27,15
Take	18,9113	7,121	1,51679

6. From 480 take 245,0075	*Ans.* 234,9925
7. From 236 dols. take ,549 dols.	*Ans.* $235,451
8. From ,145 take ,09684	*Ans.* ,04816
9. From ,2754 take ,2371	*Ans.* ,0383
10. From 271 take 215,7	*Ans.* 55,3
11. From 270,2 take 75,4075	*Ans.* 194,7925
12. From 107 take ,0007	*Ans.* 106,9993

13. From an unit, or 1, subtract the millionth part of itself. *Ans.* ,999999

* * *

MULTIPLICATION OF DECIMALS.

RULE.

1. Whether they be mixed numbers, or pure decimals, place the factors and multiply them as in whole numbers.

2. Point off so many figures from the product as there are decimal places in both the factors; and if there be not so many places in the product, supply the defect by *prefixing* cyphers to the left hand.

EXAMPLES.

1. Multiply ,5,236   2. Multiply 3,024
by ,008   by 2,23

Product ,041888   6,74352

3. Multiply 25,238 by 12,17   *Answers*, 307,14646
4. Multiply 2461 by ,0529   130,1869
5. Multiply 7853 by 3,5   27485,5
6. Multiply ,007853 by ,035   ,00027485
7. Multiply ,004 by ,004   ,000016
8. What cost 6,21 yards of cloth, at 2 dols. 32 cents, 5 mills per yard? *Ans.* $14, 4*d.* 3c. $8\frac{25}{100}$*m.*
9. Multiply 7,02 dollars by 5,27 dollars.
Ans. 36,9954*dols.* *or* $36 99*cts.* $5\frac{4}{10}$*m.*
10. Multiply 41 dols. 25 cts. by 120 dollars.
Ans. $4950
11. Multiply 3 dols. 45 cts. by 16 cts.
Ans. $0,5520=55*cts.* 2*mills.*
12. Multiply 65 cents, by ,09 or 9 cents.
Ans. $0,0585=5*cts.* 8½*mills.*
13. Multiply 10 dols. by 10 cts. *Ans.* $1
14. Multiply 341,45 dols. by ,007 or 7 mills.
Ans. $2,39+

To multiply by 10, 100, 1000, &c. remove the separating point so many places to the right hand, as the multiplier has cyphers.

So ,425 { Multiplied by 10, makes 4,25
——— by 100, makes 42,5
——— by 1000, is 425,

For ,425×10 is 4,250, &c.

DIVISION OF DECIMALS.

RULE.

1. The places of the decimal parts of the divisor and quotient counted together, must always be equal to those

in the dividend, therefore divide as in whole numbers, and from the right hand of the quotient, point off so many places for decimals, as the decimal places in the dividend exceed those in the divisor.

2. If the places in the quotient be not so many as the rule requires, supply the defect by prefixing cyphers to the left hand of said quotient.

Note.—If the decimal places in the divisor be more than those in the dividend, annex as many cyphers to the dividend as you please, so as to make it equal, (at least) to the divisor. Or, if there be a remainder, you may annex cyphers to it, and carry on the quotient to any degree of exactness.

EXAMPLES.

9,51)77,4114(8,14
76,08
1,331
951
3804
3804
00

3,8),21318(,0561
190
231
228
38
38
00

3. Divide 780,517 by 24,3	*Answers.* 32,12
4. Divide 4,18 by ,1812	,23068+
5. Divide 7,25406 by 957	,00758
6. Divide ,00078759 by ,525	,00150+
7. Divide 14 by 365	,038356+
8. Divide $246,1476 by $604,25	,40736+
9. Divide $186513,239 by $304,81	611.9+
10. Divide $1,28 by $8,31	,154+
11. Divide 56 cts. by 1 dol. 12 cts.	,5
12. Divide 1 dollar by 12 cents.	8,333+
13. If 21¾ or 21,75 yards of cloth cost 34,317 dollars, what will one yard cost?	$1,577

Note.—When decimals, or whole numbers, are to be divided by 10, 100, 1000, &c. (viz. unity with cyphers) it is performed by removing the separatrix in the dividend, so many places towards the left hand as there are cyphers in the divisor.

EXAMPLES.

572 divided by $\begin{cases} 10, \text{ the quotient, is } & 57,2 \\ 100, \text{ - - - -} & 5,72 \\ 1000, \text{ - - - -} & ,572 \end{cases}$

REDUCTION OF DECIMALS.

CASE I.

To reduce a Vulgar Fraction to its equivalent Decimal.

RULE.

Annex cyphers to the numerator, and divide by the denominator; and the quotient will be the decimal required.

NOTE. So many cyphers as you annex to the given numerator, so many places must be pointed in the quotient; and if there be not so many places of figures in the quotient, make up the deficiency by placing cyphers to the left hand of the said quotient.

EXAMPLES.

1. Reduce $\frac{1}{8}$ to a decimal. 8)1,000

Ans. ,125

	Answers.
2. What decimal is equal to $\frac{1}{2}$?	,5
3. What decimal is equal to $\frac{3}{4}$?	,75
4. Reduce $\frac{1}{5}$ to a decimal.	,2
5. Reduce $\frac{11}{16}$ to a decimal.	,6875
6. Reduce $\frac{17}{20}$ to a decimal.	,85
7. Bring $\frac{3}{32}$ to a decimal.	,09375
8. What decimal is equal to $\frac{1}{27}$?	,037037+
9. Reduce $\frac{1}{3}$ to a decimal.	,333333+
10. Reduce $\frac{9}{1125}$ to its equivalent decimal.	,008
11. Reduce $\frac{5}{26}$ to a decimal.	,1923076+

CASE II.

To reduce quantities of several denominations to a Decimal.

RULE.

Bring the given denominations first to a vulgar fraction by *Problem III.* page 76; and reduce said vulgar fraction to its equivalent decimal; or

Rule 2. Place the several denominations above each other, letting the highest denomination stand at the bottom; then divide each denomination (beginning at the top) by its value in the next denomination, the last quotient will give the decimal required.

EXAMPLES.

1. Reduce 12s. 6d. 3qrs. to the decimal of a pound

12

150
4

960)603,000000(,628125 *Answer.*
5760

2700
1920

7800
7680

1200
960

2400
1920

4800
4800

By Rule 2.

4	3,
12	6,75
20	12,5625
	,628125
	6

2. Reduce 15s. 9d. 3qrs. to the decimal of a pound.
Ans. ,790625

3. Reduce 9d. 3qrs. to the decimal of a shilling.
Ans. ,8125

4. Reduce 3 farthings to the decimal of a shilling.
Ans. ,0625

5. Reduce 3s. 4d. New-England Currency, to the decimal of a dollar. *Ans.* ,555555+

6. Reduce 12s. to the decimal of a pound. *Ans.* ,6

Note. When the shillings are even, half the number with a point prefixed, is their decimal expression; but if the number be odd, annex a cypher to the shillings, and then by halving them, you will have their decimal expression.

7. Reduce 1, 2, 4, 9, 16 and 19 shillings to decimals.

Shillings	1	2	4	9	16	19
Answers.	,05	,1	,2	,45	,8	,95

8. What is the decimal expression of 4*l.* 19s. 6½d.?
Ans. £4,97708+

9. Bring 34*l.* 16s. 7¾d. into a decimal expression.
Ans. £34,8322916+

10. Reduce 25*l.* 19s. 5½d. to a decimal.
Ans. £25,972916+

11. Reduce 3qrs. 2na. to the decimal of a yard.
Ans. ,875

12. Reduce 1 gallon to the decimal of a hogshead.
Ans. ,015873+

13. Reduce 7oz. 19pwt. to the decimal of a lb. troy.
Ans. ,6625

14. Reduce 3qrs. 21lb. Avoirdupois, to the decimal of an cwt. *Ans.* ,9375

15. Reduce 2 roods, 16 perches to the decimal of an acre. *Ans.* ,6

16. Reduce 2 feet 6 inches to the decimal of a yard.
Ans. ,833333+

17. Reduce 5fur. 16po. to the decimal of a mile.
Ans. ,675

18. Reduce 4½ calendar months to the decimal of a year. *Ans.* ,375

CASE III.

To find the value of a decimal in the known parts of the integer.

RULE.

1. Multiply the decimal by the number of parts in the next less denomination, and cut off so many places for a remainder, to the right hand, as there are places in the given decimal.

2. Multiply the remainder by the next inferior denomination, and cut off a remainder as before; and so on through all the parts of the integer, and the several denominations standing on the left hand, make the answer.

EXAMPLES.

1. What is the value of ,5724 of a pound sterling?

£. ,5724
20

11,4480
12

5,3760
4

1,5040 *Ans.* 11s. 5d. 1,5*qrs.*

2. What is the value of ,75 of a pound? *Ans.* 15*s.*

3. What is the value of ,85251 of a pound?
Ans. 17*s.* 0*d.* 2,4*qrs.*

4. What is the value of ,040625 of a pound?
Ans. 9¾*d.*

5. Find the value of ,8125 of a shilling. *Ans.* 9¾*d.*

6. What is the value of ,617 of an cwt.
Ans. 2*qrs.* 13*lb.* 1*oz.* 10,6*dr.*

7. Find the value of ,76442 of a pound troy.
Ans. 9*oz.* 3*pwt.* 11*gr.*

8. *What is the* value of ,875 of a yd.? *Ans.* 3*qrs.* 2*na.*

9. *What is the* value of ,875 of a hhd. of wine?
Ans. 55gal. 0qt. 1pt.

10. Find the proper quantity of ,089 of a mile.
Ans. 28*po.* 2*yds.* 1*ft.* 11,04*in.*

11. Find the proper quantity of ,9075 of an acre.
Ans. 3*r.* 25,2*po.*

12. What is the value of ,569 of a year of 365 days ?
Ans. 207*d.* 16*h.* 26*m.* 24*sec.*

13. What is the proper quantity of ,002084 of a pound troy ?
Ans. 12,00384*gr.*

14. What is the value of ,046875 of a pound avoirdupois ?
Ans. 12*dr.*

15. What is the value of ,712 of a furlong ?
Ans. 28*po.* 2*yd.* 1*ft.* 11,04*in.*

16. What is the proper quantity of ,142465 of a year ?
Ans. 51,999725*days.*

CONTRACTIONS IN DECIMALS.

PROBLEM I.

A CONCISE and easy method to find the decimal of any number of shillings, pence and farthings, (to three places) by INSPECTION.

RULE.

1. Write half the greatest even number of shillings for the first decimal figure.

2. Let the farthings in the given pence and farthings possess the second and third places; observing to increase the second place or place of hundredths, by 5 if the shillings be odd; and the third place by 1 when the farthings exceed 12, and by 2 when they exceed 36.

EXAMPLES.

1. Find the decimal of 7s. 9¾d. by inspection.

,3 = ½ 6s.
5 for the odd shillings.
39 = the farthings in 9¾d.
2 for the excess of 36.

£. ,391 = decimal required.

2. Find the decimal expression of 16s. 4½d. and 17s. 8½d. *Ans.* £ ,819, *and* £ ,885

3. Write down £47 18 10¼ in a decimal expression. *Ans.* £47,943

4. Reduce £1 8s. 2d. to an equivalent decimal. *Ans.* £1,408

PROBLEM II.

A short and easy method to find the value of any decimal of a pound by inspection.

RULE.

Double the first figure, or place of tenths for shillings, and if the second figure be 5, or more than 5, reckon another shilling; then, after this 5 is deducted, call the figures in the second and third places so many farthings, abating 1 when they are above 12, and 2 when above 36; and the result will be the answer.

Note. When the decimal has but 2 figures, if any thing remains after the shillings are taken out, a cypher must be annexed to the left hand, or supposed to be so.

EXAMPLES.

1. Find the value of £, ,679, by inspection.

12s.=double of 6
1 for the 5 in the second place which is to be [deducted out of 7.
Add 7¼d.=29 farthings remain to be added.
Deduct ¼d. for the excess of 12.

Ans. 13s. 7d.

2. Find the value of £. ,876 by inspection. *Ans.* 17s. 6¼d.

3. Find the value of £. ,842 by inspection. *Ans.* 16s. 10d.

4. Find the value of £. ,097 by inspection. *Ans.* 1s. 11¼d.

REDUCTION OF CURRENCIES.

RULES,

FOR reducing the Currencies of the several United States* into Federal Money.

CASE I.

To reduce the currencies of the different states, where a dollar is an even number of shillings, to Federal Money.

They are

New-England,
Virginia,
Kentucky, and
Tennessee.
New-York, and
North-Carolina.

RULE.

1. When the sum consists of pounds only, annex a cypher to the pounds, and divide by half the number of shillings in a dollar; the quotient will be dollars.†

2. But if the sum consists of pounds, shillings, pence, &c. bring the given sum into shillings, and reduce the pence and farthings to a decimal of a shilling; annex said decimal to the shillings, with a decimal point between, then divide the whole by the number of shillings contained in a dollar, and the quotient will be dollars, cents, mills, &c.

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[*] Formerly the pound was of the same sterling value in all the colonies as in Great-Britain, and a Spanish Dollar worth 4s6—but the legislatures of the different colonies emitted bills of credit, which afterwards depreciated in their value, in some states more, in others less, &c.

Thus a dollar is reckoned in

New-England, *Virginia,* *Kentucky, and* *Tennessee.*	6s	*New-Jersey,* *Pennsylvania,* *Delaware, and* *Maryland.*	7s6	*South-Carolina, and* *Georgia.*	4s8
New-York, & *N. Carolina.*	8s				

†Adding a cypher to the pounds, multiplies the whole by 10, bringing them into tenths of a pound; then because a dollar is just three-tenths of a pound N. E. currency, dividing those tenths by 3, brings them into dollars, &c. See Note, page 85.

EXAMPLES.

1. Reduce 73*l.* New-England and Virginia Currency, to Federal Money.   3)730

——— $ cts.

$$243\frac{1}{3}$=243 $33\frac{1}{3}$

2. Reduce 45*l.* 15*s.* 7½*d.* New-England currency, to federal money.

20   *d.*

A dollar=6)915,625   12)7,500

$152,604+ *Ans.*   ,625 *decimal.*

NOTE. 1 farthing is ,25 ⎫ which annex to the pence,
2 — = ,50 ⎬ and divide by 12, you will
3 — = ,75 ⎭ have the decimal required.

3. Reduce 345*l.* 10*s.* 11¼*d.* New-Hampshire, &c. currency, to Spanish milled dollars, or federal money.

£345 10 11¼
20   *d.*
  12)11,2500
6)6910,9375
  ,9375 *decimal.*
$1151,8229+ *Ans.*

4. Reduce 105*l.* 14*s.* 3¾*d.* New-York and North-Carolina currency, to federal money.

£105 14 3¾   *d.*
20   12)3,7500

A dollar=8)2114,3125   ,3125 *decimal.*

$264,289 06 *Ans.*
Or $ dcm. $\frac{06}{100}$

5. Reduce 431*l.* New-York currency to federal money. This being pounds only.*— 4)4310

——— $ cts.

Ans. $1077½=1077,50

**A dollar is 8s. in this currency—,4=$\frac{4}{10}$ of a pound; therefore, multiply by 10, and divide by 4, brings the pounds into dollars, &c.*

6. Reduce 28*l.* 11*s.* 6*d.* New-England and Virginia currency, to federal money. *Ans.* $95,25*cts.*

7. Change 463*l.* 10*s.* 8*d.* New-England, &c. currency, to federal money. *Ans.* $1545, 11*cts.* 1*m.*+

8. Reduce 35*l.* 19*s.* Virginia, &c. currency, to federal money. *Ans.* $119, 83*cts.* 3*m.*+

9. Reduce 214*l.* 10*s.* 7½*d.* New-York, &c. currency, to federal money. *Ans.* $536, 32*cts.* 8*m.*+

10. Reduce 304*l.* 11*s.* 5*d.* North-Carolina, &c. currency, to federal money. *Ans.* $761, 42*cts.* 7*m.*+

11. Change 219*l.* 11*s.* 7¾*d.* New-England and Virginia currency, to federal money. *Ans.* $731, 94*cts.*+

12. Change 241*l.* New-England, &c. currency, into federal money. *Ans.* $803, 33*cts.*

13. Bring 20*l.* 18*s.* 5¾*d.* New-England currency, into dollars. *Ans.* $69, 74*cts.* 6½*m.*+

14. Reduce 468*l.* New-York currency, to federal money. *Ans.* $1170

15. Reduce 17*s.* 9¾*d.* New-York, &c. currency, to dollars, &c. *Ans.* $2, 22*cts.* 6,5*m.*+

16. Borrowed 10 English crowns, at 6*s.* 8*d.* each, how many dollars at 6*s.* each, will pay the debt?
Ans. $11, 11*cts.* 1*m.*

NOTE.—There are several short practical methods of reducing New-England and New-York currencies to Federal Money, for which see the Appendix.

CASE II.

To reduce the currency of New-Jersey, Pennsylvania, Delaware and Maryland, to Federal Money.

RULE.

Multiply the given sum by 8, and divide the product by 3, and the quotient will be dollars, &c.*

EXAMPLES.

1. Reduce 245*l.* New-Jersey, &c. currency, to federal money.

£245×8=1960, *and* 1960÷3=$653⅓=$653, 33⅓*cts.*

NOTE.—When there are shillings, pence, &c. in the

**A dollar is 7s. 6d.=90d. in this currency=$\frac{90}{240}$=$\frac{3}{8}$ of a pound; therefore, multiplying by 8, and dividing by 3, gives the dollars, cents, &c.*

given sum, reduce them to the decimal of a pound, then multiply and divide as above, &c.

2. Reduce 36*l.* 11*s.* 8½*d.* New-Jersey, &c. currency, to federal money. £36,5854 *decimal value.*

8

———— $

3)292,6832(97,56106 *Ans.*

ANSWERS.

		£.	s.	d.		$	cts.	m.	
3.	Reduce	240	0	0	to federal money	640	00		
4.	Reduce	125	8	0	——	334	40		
5.	Reduce	99	7	6½	——	265	00	5	+
6.	Reduce	100	0	0	——	266	66	6	+
7,	Reduce	25	3	7	——	67	14	4	
8.	Reduce	0	17	9	——	2	36	6,6	

CASE III.

To reduce the currency of South-Carolina and Georgia, to federal money.

RULE.

Multiply the given sum by 30, and divide the product by 7, the quotient will be the dollars, cents, &c.*

EXAMPLES.

1. Reduce 100*l.* South-Carolina and Georgia currency, to federal money.

100*l.*×30=3000; 3000÷7=$428,5714 *Ans.*

2. Reduce 54*l.* 16*s.* 9¾*d.* Georgia currency, to federal money. 54,8406 *decimal expression.*

30

————

7)1545,2180

————

Ans. 235,0311

ANSWERS.

		£.	s.	d.		$	cts.	m.
3.	Reduce	94	14	8	to federal money,	405	99	8+
4.	Reduce	19	17	6½	——	85	18	7+
5.	Reduce	417	14	6	——	1790	25	
6.	Reduce	140	10	0	——	602	14	2+
7.	Reduce	160	0	0	——	685	71	4

---

*4*s.* 8*d.* *or* 56*d* *to the dollar* $=\frac{56}{240}=\frac{7}{30}$ *of a pound; therefore* ×30÷7.

	£.	s.	d.		$	cts.	m.
8. Reduce	0	11	6	———	2	46	4+
9. Reduce	41	17	9	———	179	51	$4\frac{8}{18}$

CASE IV.

To reduce the currency of Canada and Nova-Scotia, to Federal Money.

RULE.

Multiply the given sum by 4, the product will be dollars.

NOTE. Five shillings of this currency are equal to a dollar; consequently 4 dollars make one pound.

EXAMPLES.

1. Reduce 125*l.* Canada and Nova-Scotia currency, to federal money.

$$\begin{array}{r} 125 \\ 4 \\ \hline \end{array}$$

Ans. $500

2. Reduce 55*l.* 10*s.* 6*d.* Nova-Scotia currency, to dollars.

$$\begin{array}{r} 55{,}525 \\ 4 \\ \hline \end{array}$$ *decimal value.*

$ *cts.*

Ans. $222, 100=222 10

	£.	s.	d.		ANSWERS.
3. Reduce	241	18	9	to federal money.	967 75
4. Reduce	58	13	6½	———	234 70
5. Reduce	528	17	8	———	2115 53
6. Reduce	1	2	6	———	4 50
7. Reduce	224	19	0	———	899 80
8. Reduce	0	13	11½	———	2 79

REDUCTION OF COIN.

RULES

For reducing the Federal Money to the currencies of the several United States.

To reduce Federal Money to the currency of

1.	*New-England,* *Virginia,* *Kentucky, and* *Tennessee*	RULE.	Multiply the given sum by .3 and the product will be pounds and decimals of a pound.

2.	*New-York, & N. Carolina.*	RULE.	Multiply the given sum by ,4 and the product will be pounds, and decimals of a pound.
3.	*New-Jersey, Pennsylvania, Delaware, & Maryland.*	RULE.	Multiply the given sum by ,3 and divide the product by 8, & the quotient will be pounds, and decimals of a pound.
4.	*South-Carolina, and Georgia.*	RULE.	Multiply the given sum by ,7 and divide by 30, the quotient will be the answer in pounds, and decimals of a pound.

EXAMPLES,

In the foregoing Rules.

1. Reduce $152, 60 cts. to New-England currency.
,3
£45, 780 *Ans.*=£45 15s. 7,2*d.*
20
15, 600
12
7, 200

But the value of any decimal of a pound, may be found by inspection. See problem 11. page 88.

2. In $196, how many pounds, N. England currency.
,3
£58,8 *Ans.*=£58 16

3. Reduce $629 into New-York, &c. currency.
,4
£251,6 *Ans.*=£251 12

4. Bring $110, 51 cts. 1 m. into New-Jersey, &c. *currency.*

$110,511
3

8)331,533

£41,441 *Ans.*=£41 8s. 9¾d. *by Inspection.*

Double 4 makes 8s. Then 39 farthings is 9d. 3qrs. See Problem II. page 88.

5. Bring $65, 36 cts. into South-Carolina, &c. currency.

,7

3),45, 752

£15,250=£15 5s. *Ans.*

	$ *cts.*		ANSWERS. £.	*s.*	*d.*
6. Reduce	425.07	to N. E. &c. currency.	127	10	5 +
7. Reduce	36,11	to N. Y. &c. currency.	14	8	10½+
8. Reduce	315,44	to N. J. &c. currency.	118	5	9½+
9. Reduce	690,45	to S. C. &c. currency.	161	2	1,2

To reduce Federal Money to Canada and Nova-Scotia Currency.

RULE.

Divide the Dollars, &c. by 4, the quotient will be pounds, and decimals of a pound.

EXAMPLES.

1. Reduce $741 into Canada and Nova-Scotia currency.

$ *cts.*
4)741,00

£185,25=£185 5s.

2. Bring $311, 75 cts. into Nova-Scotia currency.

$ *cts.*
4)311,750

£77,9375=£77 18s. 9*d.*

3. Bring $2907, 56 cts. into Nova-Scotia currency.

Ans. £726 17s. 9½*d.*

4. Reduce $2114, 50 cts. into Canada currency.

Ans. £528 12s. 6d.

RULES, for reducing the currencies of the several Uni-
to the par of all the others. See the given currency
right hand, till you come under the required currency,

	N. England, Virginia, Kentucky, and Tennessee.	*New-Jersey, Pennsylvania, Delaware, and Maryland.*	*New-York, and N. Carolina.*
N. England, Virginia, Kentucky, and Tennessee.		Add one 4th to the given sum.	Add one 3d to the given sum.
New-Jersey, Pennsylvania, Delaware, and Maryland.	Deduct one fifth from the given sum.		Add one fifteenth to the given sum.
New-York, and North-Carolina.	Deduct one 4th from the New-York, &c.	Deduct one 16th from the New-York.	
South-Carolina, and Georgia.	Multiply the given sum by 9, and divide the product by 7.	Multiply the given sum by 45, and divide the product by 28.	Multiply the given sum by 12, and divide the product by 7.
Canada, and Nova-Scotia.	Add one 5th to the Canada, &c.	Add one half to the Canada sum.	Multiply the given sum by 8, and divide the product by 5.
Sterling.	To the English sum add one third.	Multiply the Engl'h money by 5, and divide the product by 3.	Multiply the English sum by 16, and divide the product by 9.

ted States, also Canada, Nova-Scotia, and Sterling, each in the left hand column, and then cast your eye to the and you will have the rule.

South-Carolina, and Georgia.	*Canada, and Nova-Scotia.*	*Sterling.*
Multiply the given sum by 7, and divide the product by 9.	Multiply the given sum by 5, and divide the product by 6.	Deduct one fourth from the given sum.
Multiply the given sum by 28, and divide the product by 45.	Deduct one third from the given sum.	Multiply the given sum by 3, and divide the product by 5.
Multiply the given sum by 7, and divide the product by 12.	Multiply the given sum by 5, and divide the product by 8.	Multiply the given sum by 9, and divide the product by 16.
	Multiply the given sum by 15, and divide the product by 14.	From the given sum, deduct one twenty-eighth.
Deduct one fifteenth from the given sum.		Deduct one tenth from the given sum.
To the English money add one twenty-seventh.	Add one ninth to the given sum.	

APPLICATION

Of the Rules contained in the foregoing Table.

EXAMPLES.

1. Reduce 46*l.* 10*s.* 6*d.* of the currency of New-Hampshire, into that of New-Jersey, Pennsylvania, &c.

	£. s. d.
See the Rule	4)46 10 6
in the Table.	+11 12 7½
	Ans. £58 3 1½

2. Reduce 25*l.* 13*s.* 9*d.* Connecticut currency, to New-York currency.

	£. s. d.
	3)25 13 9
By the Table, +⅓ &c.	+8 11 3
	Ans. £34 5 0

3. Reduce 125*l.* 10*s.* 4*d.* New-York, &c. currency, to South-Carolina currency.

	£. s. d.
Rule by the Table,	125 10 4
×7, ÷ by 12, &c.	7
	12)878 12 4
	Ans. £73 4 4⅓

4. Reduce 46*l.* 11*s.* 8*d.* New-York and North-Carolina currency, to sterling or English Money.

	£. s. d.
	46 11 8
	9
See the Table. × given sum by 9 ÷ 16, &c.	16=4×4)419 5 0 4)104 16 3
	Ans. £26 4 0¾

To reduce any of the different currencies of the several States into each other, at par; you may consult the following Table, which will give you the Rules.

MORE EXAMPLES FOR EXERCISE.

5. Reduce 84*l.* 10*s.* 8*d.* New-Hampshire, &c. currency, into New-Jersey currency.
Ans. £105 13*s.* 4*d.*

6. Reduce 120*l.* 8*s.* 3*d.* Connecticut currency, into New-York currency. *Ans.* £160 11*s.* 0*d.*

7. Reduce 120*l.* 10*s.* Massachusetts currency, into South-Carolina and Georgia currency.
Ans. £93 14*s.* 5¼*d.*

8. Reduce 410*l.* 18*s.* 11*d.* Rhode-Island currency, into Canada and Nova-Scotia currency.
Ans. £342 9*s.* 1*d.*

9. Reduce 524*l.* 8*s.* 4*d.* Virginia, &c. currency, into Sterling money. *Ans.* £393 6*s.* 3*d.*

10. Reduce 214*l.* 9*s.* 2*d.* New-Jersey, &c. currency, into New-Hampshire, Massachusetts, &c. currency.
Ans. £171 11*s.* 4*d.*

11. Reduce 100*l.* New-Jersey, &c. currency, into N. York and North-Carolina currency.
Ans. £106 13*s.* 4*d.*

12. Reduce 100*l.* Delaware and Maryland currency, into Sterling money. *Ans.* £60.

13. Reduce 116*l.* 10*s.* New-York currency, into Connecticut currency. *Ans.* £87. 7*s.* 6*d.*

14. Reduce 112*l.* 7*s.* 3*d.* S. Carolina and Georgia currency, into Connecticut, &c. currency.
Ans. £144 9*s.* 3¾*d.*

15. Reduce 100*l.* Canada and Nova-Scotia currency, into Connecticut currency. *Ans.* £ 120.

16. Reduce 116*l.* 14*s.* 9*d.* Sterling money, into Connecticut currency. *Ans.* £155 13*s.*

17. Reduce 104*l.* 10*s.* Canada and Nova-Scotia currency, into New-York currency. *Ans.* £167 4*s.*

18. Reduce 100*l.* Nova-Scotia currency, into New-Jersey, &c. currency. *Ans.* £150

RULE OF THREE DIRECT.

THE Rule of Three Direct Teaches, by having three numbers given to find a fourth, which shall have the same proportion to the third, as the second has to the first.

1. Observe that two of the given numbers in your question are always of the same name, or kind; one of which must be the first number in stating, and the other the third number; consequently, the first and third numbers must always be of the same name, or kind; and the other number, which is of the same kind with the answer, or thing sought, will always possess the second or middle place.

2. The third term is a demand; and may be known by these or the like words before it, viz. What will; What cost? How many? How far? How long? or, How much? &c.

RULE.

1. State the question; that is, place the numbers so that the first and third terms may be of the same kind; and the second term of the same kind with the answer, or thing sought.

2. Bring the first and third terms to the same denomination, and reduce the second term to the lowest name mentioned in it.

3. Multiply the second and third terms together, and divide their product by the first term; the quotient will be the answer to the question, in the same denomination you left the second term in, which may be brought into any other denomination required.

The method of proof is by inverting the question.

NOTE.—The following methods of operation, when they can be used, perform the work in a much shorter manner than the general rule.

1. Divide the second term by the first; multiply the quotient into the third, and the product will be the answer. Or

2. Divide the third term by the first; multiply the quotient into the second, and the product will be the answer. Or

3. Divide the first term by the second, and the third by *that quotient,* and the last quotient will be the answer. Or

4. *Divide the first* term by the third, and the second by *that quotient, and* the last quotient will be the answer.

EXAMPLES.

1. If 6 yards of cloth cost 9 dollars, what will 20 yards cost at the same rate?

Here 20 yards, which moves the question, is the third term; 6 yds. the same kind, is the first, and 9 dollars the second.

Yds. \$ *Yds.*
6 : 9 : : 20
9
———
6)180
———
Ans. \$30

2. If 20 yards cost 30 dols. what cost 6 yards?

Yds. \$ *Yds.*
20 : 30 : : 6
6
———
2,0)18,0
———
Ans. \$9

3. If 9 dollars will buy 6 yards, how many yards will 30 dollars buy?

\$ *yds.* \$
9 : 6 : : 30
6
———
9)180
———
Ans. 20*yds.*

4. If 3 cwt. of sugar cost 8*l.* 8s. what will 11 cwt. 1 qr. 24 lb. cost?

3 *cwt.* 8*l.* 8*s.* *C.* *qr.* *lb.*
112 20 11 1 24
——— ——— 4
336 *lb.* 168*s.* ———
45
28
———
364
92
———
1284 *lb.*

lb. *s.*
As 336 : 168 : : 1284*lb.*
168
———
10272
7704
1284
———(2,0)
336)215712(64,2
2016 ———
———32*l.*2*s.*
1411 *Ans.*
1344
———
672
672
———

5. If one pair of stockings cost 4s. 6d. what will 19 dozen pair cost? *Ans.* £51 6*s.*

6. If 19 dozen pair of shoes cost 51*l.* 6s. what will one pair cost? *Ans.* 4*s.* 6*d.*

7. At 10½d. per pound, what is the value of a firkin of butter, weight 56 pounds? *Ans.* £2 9*s.*

8. How much sugar can you buy for 23*l.* 2s. at 9d. a pound? *Ans.* 5*C.* 2*qrs.*

9. Bought 8 chests of sugar, each 9 cwt. 2 qrs. what do they come to at 2*l.* 5s. per cwt.? *Ans.* £171.

10. If a man's wages are 75*l.* 10s. a year, what is that a calendar month? *Ans.* £6 5*s.* 10*d.*

11. If 4½ tons of hay will keep 3 cattle over the winter; how many tons will it take to keep 25 cattle the same time? *Ans.* 37½ *tons.*

12. If a man's yearly income be 208*l.* 1s. what is that a day? *Ans.* 11*s.* 4*d.* 3$\frac{73}{365}$*qrs.*

13. If a man spends 3s. 4d. per day, how much is that a year? *Ans.* £60 16*s.* 8*d.*

14. Boarding at 12s. 6d. per week, how long will 32*l.* 10s. last me? *Ans.* 1 *year.*

15. A owes B 3475*l.* but B compounds with him for 13s. 4d. on the pound; pray what must he receive for his debt? *Ans.* £2316 13*s.* 4*d.*

16. A goldsmith sold a tankard for 8*l.* 12s. at 5s. 4d. per ounce, what was the weight of the tankard? *Ans.* 2*lb.* 8*oz.* 5*pwt.*

17. If 2 cwt. 3 qrs. 21 lb. of sugar cost 6*l.* 1s. 8d. what cost 35¼ cwt.? *Ans.* £73.

18. Bought 10 pieces of cloth, each piece containing 9¾ yards, at 11s. 4½ pence per yard; what did the whole come to? *Ans.* £55 9*s.* 0¾*d.*

FEDERAL MONEY.

NOTE 1. You must state the question, as taught in the Rules foregoing, and after reducing the first and third terms to the same name, &c. you may multiply and divide according to the rules in decimals; or by the rules for multiplying and dividing Federal Money.

EXAMPLES.

19. If 7 yds. of cloth cost 15 dollars 47 cents, what will 12 yds. cost?

Yds. $ *cts.* *yds.*
7 : 15,47 : : 12
12

7)185,64

Ans. 26,52=$26, 52*cts.*

But any sum in dollars and cents may be written down as a whole number, and expressed in its lowest denomination, as in the following example: (*See Reduction of Federal Money, page* 67.)

20. What will 1 qr. 9 lb. sugar come to, at 6 dollars 45 cts. per cwt.?

qr. *lb.*
1 9
28

37 lb.

lb. *cts.* *lb.*
As 112 : 645 : : 37
37

4515
1935
cts.
112)23865(213+ *Ans.*=$2, 13.
224

146
112

345
336

9

NOTE 2. When the first and third numbers are federal money, you may annex cyphers, (if necessary) until you make their decimal places or figures at the right hand of the separatrix, equal: which will reduce them to a like denomination. Then you may multiply and divide, as in whole numbers, and the quotient will express the answer in the least denomination mentioned in the second, or middle term.

EXAMPLES.

21. If 3 dollars will buy 7 yards of cloth, how many yards can I buy for 120 dollars, 75 cents?

cts. *yds.* *cts.*
As 300 : 7 : : 12075
7

yds.
300)84525(281¾ *Ans.*
600

2452
2400

525
300

225
4

900(3*qrs.*
900

22. If 12 lb. of Tea cost 6 dols. 78 cts. and 9 mills, what will 5 lb. cost at the same rate?

lb. *mills.* *lb.*
As 12 : 6789 : : 5
5

12)33945

$cts.m.
Ans. 2828+*mills*,=2,82,8.

$ *cts.*
23. If a man lays out 121, 23 in merchandize, and thereby gains 39 dollars, 51 cts. how much will he gain by laying out 12 dollars at the same rate?

Cents. *cents.* *cents.*
As 12123 : 3951 : : 1200
1200

cts. $ *cts.*
12123)4741200(391=3,91 *Ans.*
36369

110430
109107

13230
12123

1107

24. If the wages of 15 weeks come to 64 dols. 19 cts. what is a year's wages at that rate?

Ans. $222, 52*cts.* 5*m.*

25. A man bought sheep at 1 dol. 11 cts. per head, to the amount of 51 dols. 6 cts.; how many sheep did he buy? *Ans.* 46.

26. Bought 4 pieces of cloth, each piece containing 31 yards, at 16s. 6d. per yard, (New-England currency) what does the whole amount to in federal money?

Ans. $341.

27. When a tun of wine cost 140 dollars, what cost a quart? *Ans.* 13*cts.* 8$\frac{8}{10}$*m.*

28. A merchant agreed with his debtor, that if he would pay him down 65 cents on a dollar, he would give him up a note of hand of 249 dollars, 88 cts. I demand what the debtor must pay for his note?

Ans. $162, 42*cts.* 2*m.*

29. If 12 horses eat up 30 bushels of oats in a week, how many bushels will serve 45 horses the same time?

Ans. 112½ *bushels.*

30. Bought a piece of cloth for $48 27 cts. at 1 dollar 19 cents per yard; how many yards did it contain?

Ans. 40*yds.* 2*qrs.* $\frac{30}{100}$.

31. Bought 3 hhds of sugar, each weighing 8 cwt. 1 qr. 12 lb. at 7 dollars, 26 cents per cwt. what come they to?

Ans. $182 1*ct.* 8*m.*

32. What is the price of 4 pieces of cloth, the first piece containing 21, the second 23, the third 24, and the fourth 27 yards at 1 dollar 43 cents a yard?

Ans. $135 85*cts.* 21+23+24+27=95*yds.*

33. Bought 3 hhds. of brandy, containing 61, 62, 62½ gallons, at 1 dollar, 88 cents per gallon, I demand how much they amount to? *Ans.* $355, 99*cts.*

34. Suppose a gentleman's income is 1836 dollars a year, and he spends 3 dollars 49 cents a day, one day with another, how much will he have saved at the year's end? *Ans.* $562, 15*cts.*

35. If my horse stands me in 20 cents per day keeping, what will be the charge of 11 horses for the year, at that rate? *Ans.* $803.

36. A merchant bought 14 pipes of wine, and is allowed 6 months credit, but for ready money gets it 8 cents a gallon cheaper; how much did he save by paying ready money? *Ans.* $141, 12 *cents.*

EXAMPLES—Promiscuously placed.

37. Sold a ship for 537*l.* and I owned $\frac{3}{8}$ of her; what was my part of the money? *Ans.* £201 7*s.* 6*d.*

38. If $\frac{5}{16}$ of a ship cost 781 dollars 25 cents, what is the whole worth? $

As 5 : 781,25 : : 16 : 2500 *Ans.*

39. If I buy 54 yards of cloth for 31*l.* 10s. what did it cost per Ell English? *Ans.* 14*s.* 7*d.*

40. Bought of Mr. Grocer, 11 cwt. 3 qrs. of sugar, at 8 dollars 12 cents per cwt. and gave him James Paywell's note for 19*l.* 7s. (New-England currency) the rest I pay in cash; tell me how many dollars will make up the balance? *Ans.* $30, 91 *cts.*

41. If a staff 5 feet long casts a shade on level ground 8 feet, what is the height of that steeple whose shade at the same time measures 181 feet? *Ans.* 113$\frac{1}{8}$*ft.*

42. If a gentleman has an income of 300 English guineas a year, how much may he spend, one day with another, to lay up 500 dollars at the year's end?

Ans. $2, 46*cts.* 5*m.*

43. Bought 50 pieces of kerseys, each 34 Ells-Flemish, at 8s. 4d. per Ell-English; what did the whole cost?

Ans. £425.

44. Bought 200 yards of cambrick for 90*l.* but being damaged, I am willing to lose 7*l.* 10s. by the sale of it; what must I demand per Ell-English? *Ans.* 10*s.* 3$\frac{3}{4}$*d.*

45. How many pieces of Holland, each 20 Ells-Flemish, may I have for 23*l.* 8s. at 6s. 6d. per Ell-English?

Ans. 6 *pieces.*

46. A merchant bought a bale of cloth containing 240 yards, at the rate of 7$\frac{1}{2}$ dollars for 5 yards, and sold it again at the rate of 11$\frac{1}{4}$ dollars for 7 yards; did he gain or lose by the bargain, and how much?

Ans. He gained $25, 71*cts.* 4*m.*+

47. Bought a pipe of wine for 84 dollars, and found it had leaked out 12 gallons; I sold the remainder at 12½ cents a pint; what did I gain or lose?

Ans. I gained $30.

48. A gentleman bought 18 pipes of wine at 12s. 6d. (New-Jersey currency) per gallon; how many dollars will pay the purchase? *Ans.* $3780.

49. Bought a quantity of plate, weighing 15 lb. 11 oz. 13 pwt. 17 gr. how many dollars will pay for it, at the rate of 12s. 7d. New-York currency, per ounce?

Ans. $301, 50*cts.* $2\frac{6}{10}$*m.*

50. A factor bought a certain quantity of broadcloth and drugget, which together cost 81*l.* the quantity of broadcloth was 50 yards, at 18s. per yard, and for every 5 yards of broadcloth he had 9 yards of drugget; I demand how many yards of drugget he had, and what it cost him per yard? *Ans.* 90 *yards at* 8s. *per yard.*

51. If I give 1 eagle, 2 dollars, 8 dimes, 2 cents and 5 mills, for 675 tops, how many tops will 19 mills buy?

Ans. 1 *top.*

52. Whereas an eagle and a cent just three score yards
did buy,
How many yards of that same cloth for 15 dimes had I?

Ans. 8*yds.* 3*qrs.* 3*na.*+

53. If the Legislature of a State grant a tax of 8 mills on the dollar, how much must that man pay who is 319 dollars, 75 cents on the list?

Ans. $2, 55*cts.* 8*m.*

54. If 100 dollars gain 6 dollars interest in a year, how much will 49 dollars gain in the same time?

Ans. $2, 94*cts.*

55. If 60 gallons of water, in one hour, fall into a cistern containing 300 gallons, and by a pipe in the cistern, 35 gallons run out in an hour; in what time will it be filled? *Ans. in* 12 *hours.*

56. A and B depart from the same place and travel the same road; but A goes 5 days before B, at the rate of 15 miles a day; B follows at the rate of 20 miles a day; what distance must he travel to overtake A?

Ans. 300 *miles*

RULE OF THREE INVERSE.

THE Rule of Three Inverse, teaches by having three numbers given to find a fourth, which shall have the same proportion to the second, as the first has to the third.

If more requires more, or less requires less, the question belongs to the Rule of Three Direct:

But if *more* requires *less* or *less* requires *more*, the question belongs to the Rule of Three Inverse; which may always be known from the nature and tenor of the question. For Example:

If 2 men can mow a field in 4 days, how many days will it require 4 men to mow it?

men *days* *men*
1. If 2 require 4 how much time will 4 require? Answer, 2 days. Here more requires less, viz. the more men the less time is required.

men *days* *men*
2. If 4 require 2 how much time will 2 require? Answer, 4 days. Here less requires more, viz. the less the number of men are, the more days are required—therefore the question belongs to Inverse Proportion.

RULE.

1 State and reduce the terms as in the Rule of Three Direct.

2. Multiply the first and second terms together, and divide the product by the third; the quotient will be the answer in the same denomination as the middle term was reduced into.

EXAMPLES.

1. If 12 men can build a wall in 20 days, how many men can do the same in 8 days? *Ans.* 30 *men.*

2. If a man performs a journey in 5 days, when the day is 12 hours long, in how many days will he perform it when the day is but 10 hours long? *Ans.* 6 *days.*

3. What length of board 7½ inches wide, will make a *square foot?* *Ans.* 19⅕ *inches.*

4. If five dollars will pay for the carriage of 2 cwt. 150 miles, how far may 15 cwt. be carried for the same money? *Ans.* 20 *miles.*

5. If when wheat is 7s. 6d. the bushel, the penny loaf will weigh 9oz. what ought it to weigh when wheat is 6s. per bushel? *Ans.* 11*oz.* 5*pwt.*

6. If 30 bushels of grain, at 50 cts. per bushel, will pay a debt, how many bushels at 75 cents per bushel, will pay the same? *Ans.* 20 *bushels.*

7. If 100*l.* in 12 months gain 6*l.* interest, what principal will gain the same in 8 months? *Ans.* £150.

8. If 11 men can build a house in 5 months, by working 12 hours per day—in what time will the same number of men do it, when they work only 8 hours per day? *Ans.* 7½ *months.*

9. What number of men must be employed to finish in 5 days, what 15 men would be 20 days about? *Ans.* 60 *men.*

10. Suppose 650 men are in a garrison, and their provisions calculated to last but two months; how many men must leave the garrison that the same provisions may be sufficient for those who remain five months? *Ans.* 390 *men.*

11. A regiment of soldiers consisting of 850 men are to be clothed, each suit to contain 3½ yds. of cloth, which is 1¾ yards wide, and lined with shalloon ¾ yard wide; how many yards of shalloon will complete the lining? *Ans.* 6941*yds.* 2*qrs.* 2⅔*na.*

PRACTICE.

PRACTICE is a contraction of the Rule of Three Direct, when the first term happens to be an unit or one, and is a concise method of resolving most questions that occur in trade or business where money is reckoned in pounds, shillings and pence; but reckoning in Federal Money will render this rule almost useless: for which reason I shall not enlarge so much on the subject as many other writers have done.

Tables of Aliquot, or Even Parts.

Parts of a Shilling.		
d.		*s.*
6	is	½
4	=	⅓
3		¼
2		⅙
1½		⅛
Parts of 2 Shillings.		
1s.	is	½
8d.	=	⅓
6d.		¼
4d.		⅙
3d.		⅛
2d.		1/12

Parts of a Pound.			
s.	*d.*		*£.*
10	0	is	½
6	8	=	⅓
5	0		¼
4	0		⅕
3	4		⅙
2	6		⅛
1	8		1/12

Parts of a cwt.		
lb.		*cwt.*
56	is	½
28	=	¼
16		1/7
14		⅛
7		1/16

The aliquot part of any number, is such a part of it, as being taken a certain number of times, exactly makes that number.

CASE I.

When the price of one yard, pound, &c. is an even part of one shilling.—Find the value of the given quantity at 1s. a yard, pound, &c. and divide it by that even part, and the quotient will be the answer in shillings, &c.

Or find the value of the given quantity at 2s. per yard, &c. and divide said value by the even part which the given price is of 2s. and the quotient will be the answer in shillings, &c. which reduce to pounds.

N. B. To find the value of any quantity at 2s. you need only double the unit figure for shillings; the other figures will be pounds.

EXAMPLES.

1. What will 461½ yards of tape come to, at 1½d per yd.?

s. *d.*
1½d. | ⅛ | 461 6 value of 461½ yds. at 1s. per yd.

5,7 8¼

£2 17s. 8¼d. value at 1½d.

2. What cost 256lb. of cheese at 8d. per pound?

8d. | ⅓ | £25 12s. value of 256lb. at 2s. per lb.

£8 10s. 8d value of 8d. per pound.

Yards.	*per yard,*		*£.*	*s.*	*d.*
486¼	at 1d.	*Answers.*	2	0	6¼
862	at 2d.		7	3	8
911	at 3d.		11	7	9
749	at 4d.		12	9	8
113	at 6d.		2	16	6
899	at 8d.		29	19	4

CASE II.

When the price is an even part of a pound—Find the value of the given quantity at one pound per yard, &c. and divide it by that even part, and the quotient will be the answer in pounds.

EXAMPLES.

What will 129½ yards cost at 2s. 6d. per yard?

s. d. *£. s.* *£.*
2 6 | ⅛ | 129 10 value at 1 per yard.

Ans. £16 3*s.* 9*d.* value at 2s. 6d. per yard.

Yds.		*s.*	*d.*			*£.*	*s.*	*d.*
123	at	10	0	per yard.	*Answers.*	61	10	0
687½	at	5	0	—		171	17	6
211¼	at	4	0	—		42	5	0
543	at	6	8	—		181	0	0
127	at	3	4	—		21	3	4
461	at	1	8	—		38	8	4

NOTE. When the price is pounds only, the given quantity multiplied thereby, will be the answer.

EXAMPLE.—11 tons of hay at 4*l.* per ton. Thus 11
×4

Ans. £44

CASE III.

When the given price is any number of shillings under 20.

1. When the shillings are an even number, multiply

the quantity by half the number of shillings, and double the first figure of the product for shillings; and the rest of the product will be pounds.

2. If the shillings be odd, multiply the quantity by the whole number of shillings, and the product will be the answer in shillings, which reduce to pounds.

EXAMPLES.

1st. 124 yds. at 8s.
4

£49 12s. *Ans.*

2d. 132 yds. at 7s. per yd.
7

2,0)92,4

£46,4 *Ans.*

Yds.			£.	s.	*Yds.*			£.	s.
562 at	4s.	*Ans.*	112	8	372 at	11s.	*Ans.*	204	12
378 at	2s.		37	16	264 at	9s.		118	16
915 at	14s.		639	2	250 at	16s.		200	00

CASE IV.

When the given price is pence, or pence and farthings, and not an even part of a shilling—Find the value of the given quantity as 1s. per yard, &c. which divide by the greatest even part of a shilling contained in the given price, and take parts of the quotient for the remainder of the price, and the sum of these several quotients will be the answer in shillings, &c. which reduce to pounds.

EXAMPLES.

What will 245 lb. of raisins come to, at 9¾d. per lb.?

		s.	d.	
6d.	½	245	0	value of 245 lb. at 1s. per pound.
3d.	½	122	6	value of do. at 6d. per lb.
¾d.	¼	61	3	value of do. at 3d. per lb.
		15	3¾	value of do. at ¾d. per lb.
		2,0)19,9	0¾	

Ans. £9 19 0¾ value of the whole at 9¾d. per lb.

372 at 1¾	*Ans.*	2	14	3	576 at 7½	*Ans.*	18	0	0
325 at 2¼		3	0	11¼	541 at 9¼		20	17	0¼
827 at 4½		15	10	1½	672 at 11¾		32	18	0

CASE V.

When the price is shillings, pence and farthings, and not the aliquot part of a pound—Multiply the given quantity by the shillings, and take parts for the pence and farthings, as in the foregoing cases, and add them together; the sum will be the answer in shillings.

EXAMPLES.

1. What will 246 yds. of velvet come to, at 7s. 3d. per yard?

```
                s.  d.
   3d | ¼ | 246  6  0  value of 246 yards at 1s. per yd.
                7
        ----------
         1722  0  value of do. at 7s. per yard.
           61  6  value of do. at 3d. per yard.
        ----------
   2,0)178,3   6
        ----------
 Ans. £89  3   6  value of do. at 7s. per yard.
```

	s.	d.		ANSWERS. £.	s.	d.
2. What cost 139 yds. at	9	10	per yd.?	68	6	10
3. What cost 146 yds. at	14	9	per yd.?	107	13	6
4. What cost 120 cwt. at	11	3	per cwt.?	67	10	
5. What cost 127 yds. at	9	8½	per yd.?	61	12	11½
6. What cost 49½ lbs. at	3	11½	per lb.?	9	15	11¼

CASE VI.

When the price and quantity given are of several denominations—Multiply the price by the integers in the given quantity, and take parts for the rest from the price of an integer; which added together will be the answer. This is applicable to Federal Money.

EXAMPLES.

1. What cost 5cwt. 3qrs. 14lb. of raisins, at 2*l.* 11s. 8d. per cwt.?

		£.	s.	d.
2 qrs.	½	2	11	8
				5
		12	18	4
1 qr	½	1	5	10
14 lb.	½		12	11
			6	5½
Ans.		£15	3	6½

2. What cost 9cwt. 1qr. 8lb. of sugar, at 8 dollars, 65 cts. per cwt.?

		$ *cts.*
1 qr.	¼	8,65
		9
		77,85
7 lb.	¼	2,1625
1 lb.	1/7	,5406
		,772
Ans.		$80,6303

C.	*qrs.*	*lb.*		ANSWERS.
7	3	16	at $9, 58cts. per cwt.	$75, 61*cts.* 3*m.*
5	1	0	at 2*l.* 17s. per cwt.	£14 19*s.* 3*d.*
14	3	7	at 0*l.* 13s. 8d. per cwt.	£10 2*s.* 5¼*d.*
12	0	7	at $6, 34cts. per cwt.	$76, 47*cts.* 6*m.*
0	0	24	at $11, 91cts. per cwt.	$2, 55*cts.* $2\frac{1}{10}$*m.*

TARE AND TRETT.

TARE and Trett are practical Rules for deducting certain allowances which are made by merchants, in buying and selling goods, &c. by weight; in which are noticed the following particulars:

1. *Gross Weight*, which is the whole weight of any sort of goods, together with the box, cask, or bag, &c. which contains them.

2. *Tare*, which is an allowance made to the buyer, for the weight of the box, cask, or bag, &c. which contains the goods bought, and is either at so much per box, &c.—or at so much per cwt. or at so much in the whole gross weight.

3. *Trett*, which is an allowance of 4 lb. on every 104 lb. for waste, dust, &c.

4. *Cloff*, which is an allowance made of 2 lb. upon every 3 cwt.

5. *Suttle*, is what remains after one or two allowances have been deducted.

CASE I.

When the question is an Invoice.—Add the gross weights into one sum and the tares into another; then subtract the total tare from the whole gross, and the remainder will be the neat weight.

EXAMPLES.

1. What is the neat weight of 4 hogsheads of Tobacco marked with the gross weight as follows:

	C.	*qr.*	*lb.*		*lb.*
No. 1 —	9	0	12	Tare	100
2 —	8	3	4	—	95
3 —	7	1	0	—	83
4 —	6	3	25	—	81
Whole gross	32	0	13		359 total tare.
Tare 359 lb.=	3	0	23		
Ans.	28	3	18 neat.		

2. What is the neat weight of 4 barrels of Indigo, No. and weight as follows:

	C.	*qr.*	*lb.*		*lb.*
No. 1 —	4	1	10	Tare	36
2 —	3	3	02	—	29
3 —	4	0	19	—	32
4 —	4	0	0	—	35

cwt. *qr.* *lb.*
Ans. 15 0 11

CASE II.

When the tare is at so much per box, cask, bag, &c.—Multiply the tare of 1 by the number of bags, bales, &c. the product is the whole tare, which subtract from the gross, and the remainder will be the neat weight.

EXAMPLES.

1. In 4 hhds. of sugar, each weighing 10cwt. 1qr. 15lb. gross; tare 75lb. per hhd. how much neat?

	cwt.	*qrs.*	*lb.*	
	10	1	15	gross weight of one hhd.
			4	
	41	2	4	gross weight of the whole.
75×4=	2	2	20	whole tare.
Ans.	38	3	12	neat.

2. What is the neat weight of 7 tierces of rice, each weighing 4 cwt. 1 qr. 9 lb. gross, tare per tierce 34 lb. ?
Ans. 28*C.* 0*qr.* 21*lb.*

3. In 9 firkins of butter, each weighing 2 qrs. 12 lb. gross, tare 11 lb. per firkin, how much neat ?
Ans. 4*C.* 2*qrs.* 9*lb.*

4. In 241 bls. of figs, each 3 qrs. 19 lb. gross, tare 10 lb. per barrel ; how many pounds neat ? *Ans.* 22413.

5. In 16 bags of pepper, each 85lb. 4oz. gross, tare per bag, 3lb. 5oz. ; how many pounds neat ? *Ans.* 1311.

6. In 75 barrels of figs, each 2 qrs. 27 lb. gross, tare in the whole 597 lb. ; how much neat weight ?
Ans. 50*C.* 1*qr.*

7. what is the neat weight of 15 hhds. of Tobacco, each weighing 7 cwt. 1 qr. 13 lb. tare 100 lb. per hhd. ?
Ans. 97*C.* 0*qr.* 11*lb.*

CASE III.

When the tare is at so much per cwt.—Divide the gross weight by the aliquot part of a cwt. for the tare, which subtract from the gross and the remainder will be neat weight.

EXAMPLES.

1. What is the neat weight of 44 cwt. 3 qrs. 16 lb. gross, tare 14 lb. per cwt. ?

		C.	*qrs.*	*lb.*	
14lb.	$\frac{1}{8}$	44	3	16	gross.
		5	2	12½	tare.
	Ans.	39	1	3½	neat.

2. What is the neat weight of 9 hhds. of Tobacco, each weighing gross 8 cwt. 3 qrs. 14 lb. tare 16 lb. per cwt.?

Ans. 68C. 1qr. 24lb.

3. What is the neat weight of 7 bbls. of potash, each weighing [illegible] lb. gross, tare 10 lb. per cwt.?

Ans. 1281lb. 6oz.

4. In 25 barrels of figs, each 2 cwt. 1 qr. gross, tare per cwt. 16 lb.; how much neat weight?

Ans. 48cwt. 24lb.

5. In 83 cwt. 3 qrs. gross, tare 20 lb. per cwt. what neat weight?

Ans. 68cwt. 3qrs. 5lb.

6. In 45 cwt. 3 qrs. 21 lb. gross, tare 8 lb. per cwt how much neat weight?

Ans. 42cwt. 2qrs. 17½lb.

7. What is the value of the neat weight of 8 hhds. of sugar, at $9, 54 cts. per cwt. each weighing 10 cwt. 1 qr. 14 lb. gross, tare 14 lb. per cwt.?

Ans. $692, 84cts. 2½m.

CASE IV.

When Trett is allowed with the Tare.

1. Find the tare, which subtract from the gross, and call the remainder suttle.

2. Divide the suttle by 26, and the quotient will be the trett, which subtract from the suttle, and the remainder will be the neat weight.

EXAMPLES.

1. In a hogshead of sugar, weighing 10 cwt. 1 qr. 12 lb. gross, tare 14 lb. per cwt. trett 4 lb. per 104 lb.* how much neat weight?

**This is the trett allowed in London. The reason of dividing by 26 is because 4 lb. is $\frac{1}{26}$ of 104 lb. but if the trett is at any other rate, other parts must be taken, according to the rate proposed, &c.*

cwt. qr. lb.
10 1 12
4

41
28

330
83

13=⅛)1160 gross.
145 tare.

26)1015 suttle.
39 trett.

Ans. 976*lb. neat.*

Or thus

cwt. qr. lb.
14lb=⅛)10 1 12 gross.
1 1 5 tare.

26)9 0 7 suttle.
1 11 trett.

Ans. 8 2 24

2. In 9 cwt. 2 qrs. 17 lb. gross, tare 41 lb. trett 4 lb. per 104 lb. how much neat? *Ans.* 8*cwt.* 3*qrs.* 20*lb.*

3. In 15 chests of sugar, weighing 117 cwt. 21 lb. gross, tare 173 lb. trett 4 lb. per 104, how many cwt. neat? *Ans.* 111*cwt.* 22*lb.*

4. What is the neat weight of 3 tierces of rice, each weighing 4 cwt. 3 qrs. 14 lb. gross, tare 16 lb. per cwt. and allowing trett as usual? *Ans.* 12*cwt.* 0*qrs.* 6*lb.*

5. In 25 barrels of figs, each 84 lb. gross, tare 12 lb. per cwt. trett 4 lb. per 104 lb.; how many pounds neat? *Ans.* 1803+

6. What is the value of the neat weight of 4 barrels of Spanish Tobacco; numbers, weights, and allowances as follows, at 9½d. per pound?

		cwt.	*qrs.*	*lb.*	
No 1	Gross	1	2	15	
2		1	0	25	Tare 16 lb. per cwt.
3		1	0	09	Trett 4 lb. per 104 lb.
4		0	3	21	

Ans. £17 16*s.* 3*d.*

CASE V.

When Tare, Trett, and Cloff are allowed:

Deduct the tare and trett as before, and divide the suttle by 168 (because 2 lb. is the $\frac{1}{168}$ of 3 cwt.) the quotient will be the cloff, which subtract from the suttle, and the remainder will be the neat weight.

EXAMPLES.

1. In 3 hogsheads of Tobacco, each weighing 13 cwt. 3 qrs. 23 lb. gross, tare 107 lb. per hogshead, trett 4 lb. per 104 lb. and cloff 2 lb. per 3 cwt. as usual; how much neat.

cwt. qrs. lb
13 3 23
4
55
28
443
112
1563 lb. gross of 1 hhd.
3
4689 whole gross.
107×3 = 321 tare.
26)4368 suttle.
168 trett.
168)4200 suttle.
25 cloff.
Ans. 4175 *neat weight.*

2. What is the neat weight of 26 cwt. 3 qrs. 20 lb. gross tare 52 lb. the allowance of trett and cloff as usual?

Ans. neat 25cwt. 1qr. 5lb. 1oz. *nearly; omitting* further fractions.

INTEREST.

INTEREST is of two kinds; Simple and Compound.

SIMPLE INTEREST.

Simple Interest is the sum paid by the borrower to the lender for the use of money lent; and is generally at a certain rate per cent. per annum, which in several of the United States is fixed by law at 6 per cent. per annum; that is, 6*l.* for the use of 100*l.* or 6 dollars for the use of 100 dollars for one year, &c.

Principal, is the sum lent.

Rate, is the sum per cent. agreed on.

Amount, is the principal and interest added together.

CASE I.

To find the interest of any given sum for one year.

RULE.

Multiply t[illegible]al by the rate per cent. and divide the product b[illegible]e quotient will be the answer.

EXAMPLES.

1. What is the interest of 39*l.* 11s. 8½d. for one year, at 6*l.* per cent. per annum?

£. s. d.
39 11 8½
6
2|37 10 3
20
7|50
12
6|03
4
0|12 *Ans.* £2 7*s.* 6*d.* $\frac{3}{100}$

2. *What is the* interest of 236*l.* 10s. 4d. for a year, at *5 per cent.?* Ans. £11 16s. 6d.

3. What is the interest of 571*l.* 13s. 9d. for one year, at 6*l.* per cent.? *Ans.* £34 6*s.* 0¼*d.*

4. What is the interest of 2*l.* 12s. 9½d. for a year, at 6*l.* per cent.? *Ans.* £0 3*s.* 2*d.*

FEDERAL MONEY.

5. What is the interest of 468 dols. 45 cts. for one year at 6 per cent.?

$ *cts.*
468, 45
6

28|10, 70=$28, 10*cts.* 7*m.* *Ans.*

Here I cut off the two right hand integers, which divide by 100: but to divide federal money by 100, you need only call the dollars so many cents, and the inferior denominations decimals of a cent, and it is done.

Therefore you may multiply the principal by the rate, and place the separatrix in the product, as in multiplication of federal money, and all the figures at the left of the separatrix, will be the interest in cents, and the first figure on the right will be mills, and the others decimals of a mill, as in the following

EXAMPLES.

6. Required the interest of 135 dols. 25 cts. for a year at 6 per cent.

$ *cts.*
135, 25
6

811, 50=$8, 11*cts.* 5*m.* *Ans.*

7. What is the interest of 19 dollars 51 cents for one year at 5 per cent.?

$ *cts*
19, 51
5

97, 55=97*cts.* 5½*m.* *Ans.*

8. What is the interest of 436 dollars for one year, at 6 per cent.?

6

Ans. 2616cts.=$26, 16cts.

ANOTHER METHOD.

Write down the given principal in cents, which multiply by the rate, and divide by 100 as before, and you will have the interest for a year, in cents, and decimals of a cent, as follows:

9. What is the interest of $73, 65 cents for a year, at 6 per cent.?

Principal 7365 cents.
6

Ans. 441,90*cts.*=441$\frac{9}{10}$*cts.* *or* $4, 41*cts.* 9*m.*

10. Required the interest of $85, 45cts. for a year, at 7 per cent.?

Cents.
Principal 8545
7

Ans. 598, 15 *cents,*=$5,98*cts.* 1$\frac{1}{2}$*m.*

CASE II.

To find the simple interest of any sum of money, for any number of years, and parts of a year.

GENERAL RULE.

1st. Find the interest of the given sum for one year.

2d. Multiply the interest of one year by the given number of years, and the product will be the answer for that time.

3d. If there be parts of a year, as months and days, work for the months by the aliquot parts of a year, and for the days by the Rule of Three Direct, or by allowing 30 days to the month, and taking aliquot parts of the same.*

---

* By allowing the month to be 30 days, and taking aliquot parts thereof, you will have the interest of any ordinary sum sufficiently exact for common use; but if the sum be very large, you may say,

As 365 days : is to the interest of one year : : so is the *given number of* days : to the interest required.

EXAMPLES.

1. What is the interest of *75l.* 8s. 4d. for 5 years and 2 months, at 6*l.* per cent. per annum ?

£. *s.* *d.*	
75 8 4	£. *s.* *d.*
6	2*mo.*=$\frac{1}{6}$)4 10 6 Interest for 1 year.
	5
4|52 10 0	
20	22 12 6 do. for 5 years.
	0 15 1 do. for 2 months.
10|50	
12	£23 7 7 *Ans.*
6|00	

2. What is the interest of 64 dollars 58 cents, for 3 years, 5 months, and ten days at 5 per cent. ?

		$ 64,58
		5
		322,90 Interest for 1 year in cents, per [Case I.
		3
		968,70 do. for 3 years.
4 mo.	$\frac{1}{3}$	107,63 do. for 4 months.
1 mo.	$\frac{1}{4}$	26,90 do. for 1 month.
10 days,	$\frac{1}{3}$	8,96 do. for 10 days.

Ans. 1112,19=1112*cts.* *or* $11, 12*c.* 1$\frac{9}{10}$*m.*

3. What is the interest of 789 dollars for 2 years, at 6 per cent. ? *Ans.* $94, 68*cts.*

4. Of 37 dollars 50 cents, for 4 years, at 6 per cent. per annum ? *Ans.* 900*cts.* *or* $9.

5. Of 325 dollars 41 cts. for 3 years and 4 months, at 5 per cent. ? *Ans.* $54, 23*cts.* 5*m.*

6. Of 325*l.* 12s. 3d. for 5 years at 6 per cent. ? *Ans.* £97 13*s.* 8*d.*

7. Of 174*l.* 10s. 6d. for 3 and a half years at 6 per cent. ? *Ans.* £36 13*s.*

8. Of 150*l.* 16s. 8d. for 4 years and 7 months, at 6 per cent. ? *Ans.* £41 9*s.* 7*d.*

9. Of 1 dollar for 12 years at 5 per cent. ?
Ans. 60*cts.*

10. Of 215 dollars 34 cts. for 4 and a half years, at 3 and a half per cent. ? *Ans.* $33, 91*cts.* 6*m.*

11. What is the amount of 324 dollars, 61 cents, for 5 years and 5 months, at 6 per cent. ?
Ans. $430, 10*cts.* 8$\frac{25}{100}$*m.*

12. What will 3000*l.* amount to in 12 years and 10 months, at 6 per cent. ? *Ans.* £5310.

13. What is the interest of 257*l.* 5s. 1d. for 1 year and 3 quarters, at 4 per cent. ? *Ans.* £18 0*s.* 1*d.* 3*qrs.*

14. What is the interest of 279 dollars, 87 cents for 2 years and a half, at 7 per cent. per annum ?
Ans. $48, 97*cts.* 7½*m.*

15. What will 279*l.* 13s, 8d. amount to in 3 years and a half at 5½ per cent. per annum ?
Ans. £331 1*s.* 6*d.*

16. What is the amount of 341 dols. 60 cts. for 5 years and 3 quarters, at 7 and a half per cent. per annum ?
Ans. $488, 91½*cts.*

17. What will 730 dols. amount to at 6 per cent. in 5 years, 7 months and 12 days, or $\frac{12}{365}$ of a year ?
Ans. $975, 99*cts.*

18. What is the interest of 1825*l.* at 5 per cent. per annum, from March 4th, 1796, to March 29th, 1799, (allowing the year to contain 365 days ?) *Ans.* £280.

NOTE.—The Rules for Simple Interest serve also to calculate Commission, Brokerage, Insurance, or any thing else estimated at a *rate per cent.*

COMMISSION,

IS an allowance of so much per cent. to a factor or correspondent abroad, for buying and selling goods for his employer.

EXAMPLES.

1. What will the commission of 843*l* 10*s.* come to at *5 per cent.* ?

£. s.
843 10
5

42|17 10
20

3|50
12

6|00 £42 3s. 6*d*.

Or thus,
£. s.
£.5 is $\frac{1}{20}$)843 10

Ans. £42 3 6

2. Required the commission on 964 dols. 90 cts. at 2¼ per cent.? *Ans.* $21, 71*cts*.

3. What may a factor demand on 1¾ per cent. commission, for laying out 3568 dollars? *Ans.* $62, 44*cts*.

* * *

BROKERAGE,

IS an allowance of so much per cent. to persons assisting merchants, or factors, in purchasing or selling goods.

EXAMPLES.

1. What is the brokerage of 750*l*. 8s. 4d. at 6s. 8d. per cent.?

£. s. *d*.
750 8 4
1

7,50 8 4
20

10,08
12

1,00

Here I first find the brokerage at 1 pound per cent. and then for the given rate, which is ⅓ of a pound.

s. *d*. £. s. *d*. *qrs*.
6 8 = ⅓)7 10 1

Ans. £2 10 0 1⅓

2. What is the brokerage upon 4125 dols. at ¾ or 75 cents per cent.? *Ans.* $30, 93*cts*. 7½*m*.

3. If a broker sells goods to the amount of 5000 dols. what is his demand at 65 cts. per cent.?
Ans. $32, 50*cts*.

4. What may a broker demand, when he sells goods to the value of 508*l.* 17s. 10d. and I allow him 1½ per cent.? *Ans.* £7 12*s.* 8*d.*

INSURANCE,

IS a premium at so much per cent. allowed to persons and offices, for making good the loss of ships, houses, merchandize, &c. which may happen from storms, fire, &c.

EXAMPLES,

1. What is the insurance of 725*l.* 8s. 10d. at 12½ per cent.? *Ans.* £90 13*s.* 7¼*d.*

2. What is the insurance of an East-India ship and cargo, valued at 123425 dollars, at 15½ per cent.? *Ans.* $19130, 87*cts.* 5*m.*

3. A man's house estimated at 3500 dollars, was insured against fire, for 1¾ per cent. a year: what insurance did he annually pay? *Ans.* $61, 25*cts.*

SHORT PRACTICAL RULES,

For calculating Interest at 6 *per cent. either for months, or months and days.*

I. FOR STERLING MONEY.

RULE.

1. If the principal consists of pounds only, cut off the unit figure, and as it then stands it will be the interest for one month, in shillings and decimal parts.

2. If the principal consists of pounds, shillings, &c. reduce it to its decimal value; then remove the decimal point one place, or figure, further towards the left hand, and as the decimal then stands, it will shew the interest for one month, in shillings, and decimals of a shilling.

EXAMPLES,

1. Required the interest of 54*l.* for seven months and *ten days,* at 6 per cent

s.
10 days=$\frac{1}{3}$)5,4 Interest for one month.
7
―――
37,8 ditto for 7 months.
1,8 ditto for 10 days.
―――
[*Ans.* 39,6 shillings=£1 19s. 7,2*d.*
12
―――
7,2

2. What is the interest of 42*l.* 10s. for 11 months, at 6 per cent.?

£. s. £.
42 10 = 42,5 decimal value.
Therefore 4,25 shillings interest for 1 month.
11
――― £. s. *d.*
Ans. 46,75 Interest for 11 mo. = 2 6 9

3. Required the interest of 94*l.* 7s. 6d. for one year, five months and a half, at 6 per cent. per annum.
Ans. £8 5*s.* 1*d.* 3,5*qrs.*

4. What is the interest of 12*l.* 18s. for one third of a month, at 6 per cent.? *Ans.* 5,16*d.*

* * *

II. FOR FEDERAL MONEY.

RULE.

1. Divide the principal by 2, placing the separatrix as usual, and the quotient will be the interest for one month in cents, and decimals of a cent; that is, the figures at the left of the separatrix will be cents, and those on the right, decimals of a cent.

2. Multiply the interest of one month by the given number of months, or months, and decimal parts thereof, or for the days take the even parts of a month, &c.

EXAMPLES.

1. What is the interest of 341 dols. 52 cts. for 7½ months?

2)341,52

170,76 Int. for 1 month.

7½

1195,32 do. for 7 mo.

85,38 do. for ½ mo.

1280,70 *Ans.* 1280,7*cts.*=$12, 80*cts.* 7*m.*

Or thus, 170,76 Int. for 1 month.

×7,5 months.

85380

119532

1280,700*cts.* =12,80 7 ($ *cts.* *m.*)

2. Required the interest of 10 dols. 44 cts. for 3 years, 5 months and 10 days.

2)10,44

10 days=⅓) 5,22 Interest for 1 month.

41 months.

5,22

208,8

214,02 ditto for 41 months.

1,74 ditto for 10 days.

215,76*cts.* *Ans.*=$2, 15*cts.* 7*m.*+

3. What is the interest of 342 dollars for 11 months?

The ½ is 171 Interest for one month.

11

Ans. 1881*cts.*=$18, 81*cts.*

NOTE.—To find the interest of any sum for 2 months, at 6 per cent. you need only call the dollars so many cents, and the inferior denominations decimals of a cent, and it is done: Thus, the interest of 100 dollars for two months, is 100 cents, or 1 dollar; and $25, 40 cts. is 25 cts. 4 m. &c. which gives the following

RULE II.

Multiply the principal by half the number of months, and the product will shew the interest for the given time, *in cents and* decimals of a cent, as above.

EXAMPLES.

1. Required the interest of 316 dollars for 1 year and 10 months.
11=half the number of mo.

Ans. 3476*cts.*=$34, 76*cts.*

2. What is the interest of 364 dols. 25cts. for 4 months?
$ *cts.*
364, 25
2 half the months.

728, 50*cts.* *Ans.*=$7, 28*cts.* 5*m.*

III. When the principal is given in federal money, at 6 per cent. to find how much the monthly interest will be in New-England, &c. currency.

RULE.

Multiply the given principal by ,03 and the product will be the interest for one month, in shillings and decimal parts of a shilling.

EXAMPLES.

1. What is the interest of 325 dols. for 11 months?
,03

9,75 shil. int. for 1 month.
×11 months.

Ans. 107,25*s.*=£5 7*s.* 3*d.*

2. What is the interest in New-England currency, of 31 dols. 68 cts. for 5 months?
Principal 31,68 dols.
,03

,9504 Interest for one month.
5

Ans. 4,7520s.=4*s.* 9*d.*
12

9,0240

IV. When the principal is given in pounds, shillings, &c. New-England currency, at 6 per cent. to find how much the monthly interest will be in federal money.

RULE.

Multiply the pounds, &c. by 5, and divide that product by 3, the quotient will be the interest for one month, in cents, and decimals of a cent, &c.

EXAMPLES.

1. A note for £411 New-England currency has been on interest one month; how much is the interest thereof in federal money?

```
      £.
     411
       5
    ----
  3)2055
    ----
Ans. 685cts.=$6, 85cts.
```

2. Required the interest of 39*l.* 18s. N. E. currency, for 7 months?

```
                    £.
                   39,9  decimal value.
                      5
                  -----
                3)199,5
                  -----
Interest for 1 mo. 66,5  cents.
                      7
                  -----
Ditto for 7 months, 465,5cts.=$4, 65cts. 5m. Ans.
```

V. When the principal is given in New-England and Virginia currency, at 6 per cent. to find the interest for a year, in dollars, cents and mills, by inspection.

RULE.

Since the interest of a year will be just so many cents as the given principal contains shillings, therefore, write down the shillings and call them cents, and the pence in the principal made less by 1 if they exceed 3, or by 2 *when* they exceed 9, will be the mills, very nearly.

EXAMPLES.

1. What is the interest of 2*l.* 5s. for a year at 6 per ct.?
£2 5s.=45s. Interest 45cts. the Answer.

2. Required the interest of 100*l.* for a year at 6 per ct.?
£100=2000s. Interest 2000cts.=$20 Ans.

3. Of 27s. 6d. for a year?
Ans. 27s. is 27cts. and 6d. is 5 mills.

4. Required the interest of 5*l.* 10s. 11d. for a year?
£5 10*s.*=110*s.* *Interest* 110*cts.*=$1, 10*cts.* 0*m.*
11 *pence—2 per rule leaves* 9= 9

Ans. $1, 10 9

* * *

VI. To compute the interest on any note or obligation, when there are payments in part, or indorsements.

RULE.

1. Find the amount of the whole principal for the whole time.

2. Cast the interest on the several payments, from the time they were paid, to the time of settlement, and find their amount; and lastly deduct the amount of the several payments, from the amount of the principal.

EXAMPLES.

Suppose a bond or note dated April 17, 1793, was given for 675 dollars, interest at 6 per cent. and there were payments indorsed upon it as follows, viz.

First payment, 148 dollars, May 7, 1794.
Second payment, 341 dols. August 17, 1796.
Third payment, 99 dols. Jan. 2, 1798. I demand how much remains due on said note, the 17th of June, 1798?

$ *cts.*
148, 00 first payment, May 7, 1794. *Yr. mo*
36, 50 interest up to—June 17, 1798.=4 1⅓

184, 50 amount.

341, 00 second payment, Aug. 17, 1796. *Yr. mo.*
37, 51 Interest to——June 17 1798. =1 10

378, 51 amount.

[Carried over.

$ *cts.*
99, 00 third payment, January 2, 1798.
2, 72 Interest to—June 17, 1798.=5½*mo.*

101, 72 amount.

184, 50 }
378, 51 } several amounts.
101, 72 }

664, 73 total amount of payments.

675, 00 note, dated April 17, 1793. *Yr. mo.*
209, 25 Interest to—June 17, 1798. =5 2

884, 25 amount of the note.
664, 73 amount of payments.

$219, 52 remains due on the note, June 17, 1798.

2. On the 16th of January, 1795, I lent James Paywell 500 dollars, on interest at 6 per cent. which I received back in the following partial payments, as under, viz.

	$
1st of April, 1796 - - - - -	50
16th of July, 1797 - - - - -	400
1st of Sept. 1798 - - - - -	60

How stands the balance between us, on the 16th November, 1800? *Ans. due to me* $63, 18*cts.*

3. A PROMISSORY NOTE, VIZ.

£62 10s. *New-London, April* 4, 1797.

On demand I promise to pay Timothy Careful, sixty-two pounds, ten shillings, and interest at 6 per cent. per annum, till paid; value received.

JOHN STANBY, PETER PAYWELL.
RICHARD TESTIS.

Indorsements.

	£.	s.
1st. Received in part of the above note, September 4, 1799.	50	0
And payment June 4, 1800,	12	10

How much remains due on said note, the fourth day of December, 1800?

	£.	s.	d.
Ans.	9	12	6

NOTE.—*The preceding Rule, by custom is rendered so popular, and so much practised and esteemed by many on account of its being simple and concise, that I have given it a place: it may answer for short periods of time, but in a long course of years, it will be found to be very erroneous.*

Although this method seems at first view to be upon the ground of simple interest, yet upon a little attention the following objection will be found most clearly to lie against it, viz. that the interest will, in a course of years, completely expunge, or as it may be said, eat up the debt. For an explanation of this, take the following

EXAMPLE.

A lends B 100 dollars, at 6 per cent. interest, and takes his note of hand; B does no more than pay A at every year's end 6 dollars, (which is then justly due to B for the use of his money) and has it endorsed on his note. At the end of 10 years B takes up his note, and the sum he has to pay is reconed thus: The principal 100 dollars, on interest 10 years amounts to 160 dollars; there are nine endorsements of 6 dollars each, upon which the debtor claims interest; one for 9 years, the second for 8 years, the third for 7 years, and so down to the time of settlement; the whole amount of the several endorsements and their interests, (as any one may see by casting it) is $70, 20 cts. this subtracted from 160 dols. the amount of the debt, leaves in favor of the creditor, $89, 40 cts. or $10, 20 cts. less than the original principal, of which he has not received a cent, but only its annual interest.

If the same note should lie 20 years in the same way B would owe but 37 dols. 60 cts. without paying the least fraction of the 100 dollars borrowed.

Extend it to 28 years, and A the creditor would fall in debt to B, without receiving a cent of the 100 dollars which he lent him. See a better Rule in Simple Interest by decimals, page 175.

COMPOUND INTEREST,

Is when the interest is added to the principal, at the end of the year, and on that amount the interest cast for another year, and added again, and so on: this is called Interest upon Interest.

RULE.

Find the interest for a year, and add it to the principal, which call the amount for the first year; find the interest of this amount, which add as before, for the amount of the second, and so on for any number of years required. Subtract the original principal from the last amount, and the remainder will be the Compound Interest for the whole time.

EXAMPLES.

1. Required the amount of 100 dollars for 3 years at 6 per cent. per annum, compound interest?

		$ *cts.*		$ *cts.*	
1st	Principal	100,00	Amount	106,00	for 1 year.
2d	Principal	106,00	Amount	112,36	for 2 years.
3d	Principal	112,36	Amount	119,1016	for 3 yrs. *Ans.*

2. What is the amount of 425 dollars, for 4 years, at 5 per cent. per annum, compound interest?
Ans. $516, 59*cts.*

3. What will 400*l.* amount to, in 4 years, at 6 per cent. per annum, compound interest? *Ans.* £504 19*s.* 9¾*d.*

4. What is the compound interest of 150*l.* 10s. for 3 years, at 6 per ct. per annum? *Ans.* £28 14*s.* 11¼*d.*+

5. What is the compound interest of 500 dollars for 4 years, at 6 per cent. per annum? *Ans.* $131,238+

6. What will 1000 dollars amount to in 4 years, at 7 per cent per annum, compound interest?
Ans. $1310, 79*cts.* 6*m.*+

7. What is the amount of 750 dollars for 4 years, at 6 per cent. per annum, compound interest?
Ans. $946, 85*cts.* 7,72*m.*

8. What is the compound interest of 876 dols. 90 cts. for 3½ years, at 6 per cent. per annum?
Ans. $198, 83*cts.*+

DISCOUNT,

Is an allowance made for the payment of any sum of money before it becomes due; or upon advancing ready money for notes, bills, &c. which are payable at a future day. What remains after the discount is deducted, is the present worth, or such a sum as, if put to interest, would at the given rate and time, amount to the given sum or debt.

RULE.

As the amount of 100*l.* or 100 dollars, at the given rate and time : is to the interest of 100, at the same rate and time : : so is the given sum : to the discount.

Subtract the discount from the given sum, and the remainder is the present worth.

Or—as the amount of 100 : is to 100 : : so is the given sum or debt : to the present worth.

Proof.—Find the amount of the present worth, at the given rate and time, and if the work is right, that will be equal to the given sum.

EXAMPLES.

1. What must be discounted for the ready payment of 100 dollars, due a year hence at 6 per cent. a year?

$ $ $ $ *cts.*
As 106 : 6 : : 100 : 5 66 the answer.
100,00 given sum.
5,66 discount.

$94,34 the present worth.

2. What sum in ready money will discharge a debt of 925*l.* due 1 year and 8 months hence, at 6 per cent.?

£100
10 Interest for 20 months.

110 Am't. £. £. £. £. *s.* *d.*
As 110 : 100 : : 925 : 840 18 2+*Ans.*

3. What is the present worth of 600 dollars, due 4 years hence, at 5 per cent.? *Ans.* $500

4. What is the discount of 275*l.* 10s. for 10 months, at 6 per cent. per annum? *Ans.* £13 2s. 4½d.

5. Bought goods amounting to 615 dols. 75 cents, at 7 months credit; how much ready money must I pay, discount at 4½ per cent. per annum? *Ans.* $600.

6. What sum of ready money must be received for a bill of 900 dollars, due 78 days hence, discount at 6 per cent. per annum? *Ans.* $889, 32*cts.* 8*m.*

Note.—When sundry sums are to be paid at different times, find the Rebate or present worth of each particular payment separately, and when so found, add them into one sum.

EXAMPLES.

7. What is the discount of 750*l.* the one half payable in six months, and the other half in six months after that, at 7 per cent.? *Ans.* £37 10*s.* 2½*d.*

8. If a legacy is left me of 2000 dollars, of which 500 dols. are payable in 6 months, 800 dols. payable in 1 year, and the rest at the end of 3 years; how much ready money ought I to receive for said legacy, allowing 6 per cent. discount? *Ans.* $1833, 37*cts.* 4*m.*

ANNUITIES.

An Annuity is a sum of money, payable every year, or for a certain number of years, or forever.

When the debtor keeps the annuity in his own hands, beyond the time of payment, it is said to be in arrears.

The sum of all the annuities for the time they have been forborne, together with the interest due on each, is called the amount.

If an annuity is bought off, or paid all at once, at the beginning of the first year, the price which is paid for it is called the present worth.

To find the amount of an annuity at simple interest.

RULE.

1. Find the interest of the given annuity for 1 year.

2. And then for 2, 3, &c. years, up to the given time, less 1.

3. Multiply the annuity by the number of years given and add the product to the whole interest, and the sum will be the amount sought.

EXAMPLES.

1. If an annuity of 70*l.* be forborne 5 years, what will be due for the principal and interest at the end of said term, simple interest being computed at 5 per cent. per annum?

	Yr.	£.	s.
1st. Interest of 70*l.* at 5 per cent. for	1—	3	10
	2—	7	0
	3—	10	10
	4—	14	0
2d. And 5 yrs. annuity, at 70*l.* per yr. is		350	0
	Ans.	£385	0

2. A house being let upon a lease of 7 years, at 400 dollars per annum, and the rent being in arrear for the whole term, I demand the sum due at the end of the term, simple interest being allowed at 6*l.* per cent. per annum? *Ans.* $3304.

To find the present worth of an annuity at simple interest.

RULE.

Find the present worth of each year by itself, discounting from the time it falls due, and the sum of all these present worths will be the present worth required.

EXAMPLES.

1. What is the present worth of 400 dols. per annum, to continue 4 years, at 6 per cent. per annum?

106 } : 100 : : 400 : 377,35849 = Pres. worth of 1st yr.
112 } : 100 : : 400 : 357,14285 = ——— 2d yr.
118 } : 100 : : 400 : 338,98305 = ——— 3d yr.
124 } : 100 : : 400 : 322,58064 = ——— 4th yr.

Ans. $1396,06503=$1396, 6*cts.* 5*m.*

2. How much present money is equivalent to an annuity of 100 dollars, to continue 3 years; rebate being made at 6 per cent.? *Ans.* $268, 37*cts.* 1*m.*

3. What is 80*l.* yearly rent, to continue 5 years, worth in ready money, at 6*l.* per cent.? *Ans.* £340 15s [illegible]

EQUATION OF PAYMENTS,

IS finding the equated time to pay at once, several debts due at different periods of time, so that no loss shall be sustained by either party.

RULE.

Multiply each payment by its time, and divide the sum of the several products by the whole debt, and the quotient will be the equated time for the payment of the whole.

EXAMPLES.

1. A owes B 380 dollars, to be paid as follows—viz. 100 dollars in 6 months, 120 dollars in 7 months, and 160 dollars in 10 months: What is the equated time for the payment of the whole debt?

$$\begin{array}{rcrcr} 100 & \times & 6 & = & 600 \\ 120 & \times & 7 & = & 840 \\ 160 & \times & 10 & = & 1600 \\ \hline 380 & & &) & 3040(8 \end{array}$$

months. Ans.

2. A merchant hath owing him 300*l.* to be paid as follows: 50*l.* at 2 months, 100*l.* at 5 months, and the rest at 8 months; and it is agreed to make one payment of the whole; I demand the equated time? *Ans.* 6 *months.*

3. F owes H 1000 dollars, whereof 200 dollars is to be paid present, 400 dollars at 5 months, and the rest at 15 months, but they agree to make one payment of the whole; I demand when that time must be? *Ans.* 8 *months.*

4. A merchant has due to him a certain sum of money, to be paid one sixth at 2 months, one third at 3 months, and the rest at 6 months; what is the equated time for the payment of the whole? *Ans.* $4\frac{1}{3}$ *months.*

BARTER,

IS the exchanging of one commodity for another, and directs merchants and traders how to make the exchange without loss to either party.

RULE.

Find the value of the commodity whose quantity is given; then find what quantity of the other at the proposed rate can be bought for the same money, and it gives the answer.

EXAMPLES.

1. What quantity of flax at 9 cts. per lb. must be given in barter for 12 lb. of indigo, at 2 dols. 19 cts. per lb.?

12 lb. of indigo at 2 dols. 19 cts. per lb. comes to 26 dols. 28 cts.—therefore, As 9 cts. : 1 lb. : : 26,28 cts. : 292 *the answer.*

2. How much wheat at 1 dol. 25 cts. a bushel, must be given in barter for 50 bushels of rye, at 70 cts. a bushel?
Ans. 28 *bushels.*

3. How much rice at 28s. per cwt. must be bartered for 3½ cwt. of raisins, at 5d. per lb.?
Ans. 5*cwt.* 3*qrs.* $9\frac{112}{336}$*lb.*

4. How much tea at 4s. 9d. per lb. must be given in barter for 78 gallons of brandy, at 12s. 3½d. per gallon?
Ans. 201*lb.* $13\frac{27}{57}$*oz.*

5. A and B bartered: A had 8¼ cwt. of sugar at 12 cts. per lb. for which B gave him 18 cwt. of flour; what was the flour rated at per lb.? *Ans.* 5½*cts.*

6. B delivered 3 hhds. of brandy, at 6s. 8d. per gallon, to C, for 126 yds. of cloth, what was the cloth per yard?
Ans. 10*s.*

7. D gives E 250 yards of drugget, at 30 cts. per yd. for 319 lbs. of pepper; what does the pepper stands him in per lb.? *Ans.* 23*cts.* $5\frac{1}{10}$*m.*

8. A and B bartered; A had 41 cwt. of rice, at 21s. per cwt. for which B gave him 20*l.* in money, and the rest in sugar at 8d. per lb.; I demand how much sugar B gave A besides the 20*l.*? *Ans.* 6*cwt.* 0*qrs.* 19½*lb.*

9. Two farmers bartered: A had 120 bushels of wheat, at 1½ dols. per bushel, for which B gave him 100 bushels of barley, worth 65 cts. per bushel, and the balance in oats at 40 cts. per bushel; what quantity of oats did A receive from B.? *Ans.* 287½ *bushels.*

10. A hath linen cloth worth 20d. an ell ready money; but in barter he will have 2s. B hath broadcloth worth 14s. 6d. per yard ready money, at what price ought B to rate his broadcloth in barter, so as to be equivalent to A's bartering price? *Ans.* 17s. 4d. $3\frac{2}{10}$qrs.

11. A and B barter: A hath 145 gallons of brandy at 1 dol. 20 cts. per gallon ready money, but in barter he will have 1 dol. 35 cts. per gallon: B has linen at 58 cts. per yard ready money; how must B sell his linen per yard in proportion to A's bartering price, and how many yards are equal to A's brandy?

Ans. Barter price of B's linen is 65*cts.* 2½*m.* and he must give A 300 *yds.* for his brandy.

12. A has 225 yds. of shalloon, at 2s. ready money, per yard, which he barters with B at 2s. 5d. per yard, taking indigo at 12s. 6d. per lb. which is worth but 10s. how much indigo will pay for the shalloon; and who gets the best bargain?

Ans. 43½*lb.* at barter price will pay for the shalloon, and B has the advantage in barter.

Value of A's cloth at cash price, is	£22	10
Value of 43½*lb.* of indigo, at 10s. per lb.	21	15
B gets the best bargain by	£0	15

LOSS AND GAIN,

Is a rule by which merchants and traders discover their profit or loss in buying and selling their goods: it also instructs them how to rise or fall in the price of their goods, so as to gain or lose so much per cent. or otherwise. Questions in this rule are answered by the Rule of Three.

EXAMPLES.

1. Bought a piece of cloth containing 85 yards, for 191 dols. 25 cts. and sold the same at 2 dols. 81 cts. per yard; what is the profit upon the whole piece?

Ans. $47, 60*cts.*

2. Bought 12½ cwt. of rice, at 3 dols. 45 cts. a cwt. and sold it again at 4 cts. a pound; what was the whole gain? *Ans.* $12, 87*cts.* 5*m.*

3. Bought 11 cwt. of sugar, at 6½d. per lb. but could not sell it again for any more than 2*l.* 16s. per cwt.; did I gain or lose by my bargain? *Ans. Lost,* £2 11s. 4*d.*

4. Bought 44 lb. of tea for 6*l.* 12s. and sold it again for 8*l.* 10s. 6d.; what was the profit on each pound?

Ans. 10½*d*

[illegible]. Bought a hhd. of molasses containing 119 gallons, at 52 cts. per gallon; paid for carting the same 1 dollar 25 cents, and by accident 9 gallons leaked out; at what rate must I sell the remainder per gallon, to gain 13 dollars in the whole? *Ans.* 69*cts.* 2*m.*+

II. To know what is gained or lost per cent.

RULE.

First see what the gain or loss is by subtraction; then As the price it cost : is to the gain or loss : : so is 100*l.* or $100, to the gain or loss per cent.

EXAMPLES.

1. If I buy Irish linen at 2s. per yard, and sell it again at 2s. 8d. per yard; what do I gain per cent. or in laying out 100*l.* : As : 2*s.* 8*d.* : : 100*l.* : £33 6*s.* 8*d.* *Ans.*

2. If I buy broadcloth at 3 dols. 44 cts. per yard, and sell it again at 4 dols. 30 cts. per yard; what do I gain per cent. or in laying out 100 dollars?

$ *cts.*
Sold for 4, 30
Cost 3, 44
Gained per yd. 86

$ *cts.* *cts.* $ $
As 3, 44 : 86 : : 100 : 25
Ans. 25 per cent.

3. If I buy a cwt. of cotton for 34 dols. 86 cts. and sell it again at 41½ cts. per lb. what do I gain or lose, and what per cent.?

	$ *cts.*
1 cwt. at 41½ cts. per lb. comes to	46,48
Prime cost	34,86
Gained in the gross,	$11,62

As 34,86 : 11,62 : : 100 : 33⅓ *Ans.* 33⅓ *per cent.*

4. Bought sugar at 8¼d. per lb. and sold it again at 4*l.* 17s. per cwt. what did I gain per cent.?
Ans. £25 19*s.* 5¾*d.*

5. If I buy 12 hhds. of wine for 204*l.* and sell the same again at 14*l.* 17s. 6d. per hhd. do I gain or lose, and what per cent.? *Ans. I lose* 12½ *per cent.*

6. At 1½d. profit in a shilling, how much per cent.?
Ans. £12 10*s.*

7. At 25 cts. profit in a dollar, how much per cent.?
Ans. 25 *per cent.*

NOTE.—When goods are bought or sold on credit, you must calculate (by discount) the present worth of their price, in order to find your true gain or loss, &c.

EXAMPLES.

1. Bought 164 yards of broadcloth, at 14s. 6d. per yd. ready money, and sold the same again for 154*l.* 10s. on 6 months credit; what did I gain by the whole; allowing discount at 6 per cent. a year?

£. £. £. s. £. s.
As 103 : 100 : : 154 10 : 150 0 present worth.
118 18 prime cost.

Gained £31 2 *Answer.*

2. If I buy cloth at 4 dols. 16 cts. per yard, on eight months credit, and sell it again at 3 dols. 90 cts. per yd. ready money, what do I lose per cent. allowing 6 per cent. discount on the purchase price? *Ans.* 2½ *per cent.*

III. To know how a commodity must be sold, to gain or lose so much per cent.

RULE.

As 100 : is to the purchase price : : so is 100*l.* or 100 dols. with the profit added, or loss subtracted : to the selling price.

EXAMPLES.

1. If I buy Irish linen at 2s. 3d. per yard; how must I sell it per yard to gain 25 per cent.?
As 100*l.* : 2*s.* 3*d.* : : 125*l.* to 2*s.* 9*d.* 3*qrs. Ans.*

2. If I buy Rum at 1 dol. 5 cts. per gallon; how must I sell it per gallon to gain 30 per cent.?
As $100 : $1,05 : : $130 : $1,36½*cts. Ans.*

3. If tea cost 54 cents per lb.; how must it be sold per lb. to lose 12½ per cent.?
As $100 : 54 cts. : : $87, 50 cts. : 47*cts.* 2½*m. Ans.*

4. Bought cloth 17s. 6d. per yard, which not proving so good as I expected, I am obliged to lose 15 per cent. by it; how must I sell it per yard? *Ans.* 14*s.* 10½*d.*

5. If 11 cwt. 1 qr. 25 lb. of sugar cost 126 dols. 50 cts. how must it be sold per lb. to gain 30 per cent.?

Ans. 12*cts.* 8*m.*

6. Bought 90 gallons of wine at 1 dol. 20 cts. per gall. but by accident 10 gallons leaked out, at what rate must I sell the remainder per gallon to gain upon the whole prime cost, at the rate of 12½ per cent.? *Ans.* $1, 51*cts.* $8\frac{7}{10}$*m.*

IV. When there is gained or lost per cent. to know what the commodity cost.

RULE.

As 100*l.* or 100 dols. with the gain per cent. added, or loss per cent. subtracted, is to the price; so is 100 to the prime cost.

EXAMPLES.

1. If a yard of cloth be sold at 14s. 7d. and there is gained 16*l.* 13s. 4d. per cent.; what did the yard cost?

£. *s.* *d.* *s.* *d.* £.
As 116 13 4 : 14 7 : : 100 to 12*s.* 6*d.* *Ans.*

2. By selling broadcloth at 3 dols. 25 cts. per yard, I lose at the rate of 20 per cent.; what is the prime cost of said cloth per yard? *Ans.* $4, 06*cts.* 2½*m.*

3. If 40 lb. of chocolate be sold at 25 cts. per lb. and I gain 9 per cent.; what did the whole cost me?

Ans. $9, 17*cts.* 4*m.*+

4. Bought 5 cwt. of sugar, and sold it again at 12 cents per lb. by which I gained at the rate of 25½ per cent.; what did the sugar cost me per cwt.

Ans. $10, 70*cts.* 9*m.*+

V. If by wares sold at a given rate there is so much gained or lost per cent. to know what would be gained or lost per cent. if sold at another rate.

RULE.

As the first price : is to 100*l.* or 100 dols. with the profit per cent. added, or loss per cent. subtracted : : so is the other price : to the gain or loss per cent. at the other rate.

N. B. If your answer exceed 100*l.* or 100 dols. the excess is your gain per cent.; but if it be less than 100, that deficiency is the loss per cent.

EXAMPLES.

1. If I sell cloth at 5s. per yd. and thereby gain 15 per cent. what shall I gain per cent. if I sell it at 6s. per yard?

s. £. s. £.
As 5 : 115 : : 6 : 138 *Ans. gained* 38 *per cent.*

2. If I retail rum at 1 dollar 50 cents per gallon and thereby gain 25 per cent. what shall I gain or lose per cent. if I sell it at 1 dol. 8cts. per gallon?

$ *cts.* $ $ *cts.* $
1,50 : 125 : : 1,08 : 90 *Ans. I shall lose* 10 *per cent.*

3. If I sell a cwt. of sugar for 8 dollars, and thereby lose 12 per cent. what shall I gain or lose per cent. if I sell 4 cwt. of the same sugar for 36 dollars?

Ans. I lose only 1 *per cent.*

4. I sold a watch for 17*l.* 1s. 5d. and by so doing lost 15 per cent. whereas I ought in trading to have cleared 20 per cent.; how much was it sold under its real value?

£. £. *s. d.* £. £. *s. d.*
As 85 : 17 1 5 : : 100 : 20 1 8 the prime cost.
100 : 20 1 8 : : 120 : 24 2 0 the real value.
Sold for 17 1 5

£7 0 7 *Answer.*

FELLOWSHIP,

Is a rule by which the accompts of several merchants or other persons, trading in partnership, are so adjusted, that each may have his share of the gain, or sustain his share of the loss, in proportion to his share of the joint stock.—Also by this Rule a bankrupt's estate may be divided among his creditors, &c.

SINGLE FELLOWSHIP,

Is when the several shares of stock are continued in trade an equal term of time.

RULE.

As the whole stock is to the whole gain or loss: so is each man's particular stock, to his particular share of the *gain or loss.*

PROOF.—Add all the particular shares of the gain or loss together, and if it be right, the sum will be equal to the whole gain or loss.

EXAMPLES

1. Two partners, A and B, join their stock and buy a quantity of merchandize, to the amount of 820 dollars; in the purchase of which A laid out 350 dollars, and B 470 dollars; the commodity being sold, they find their clear gain amounts to 250 dollars. What is each person's share of the gain?

A put in 350
B —— 470

$$\text{As } 820 : 250 :: \left\{ \begin{array}{l} 350 : 106{,}7073 + \text{A's share.} \\ 470 : 143{,}2926 + \text{B's share.} \end{array} \right.$$

Proof 249,9999+=$250

2. Three merchants make a joint stock of 1200*l.* of which A put in 240*l.* B 360*l.* and C 600*l.*; and by trading they gain 325*l.* what is each one's part of the gain?

Ans. A's part £65, *B's* £97 10*s.* *C's* £162 10*s.*

3. Three partners, A, B, and C, shipped 108 mules for the West-Indies; of which A owned 48, B 36, and C 24. But in stress of weather, the mariners were obliged to throw 45 of them overboard; I demand how much of the loss each owner must sustain?

Ans. A 20, *B* 15, *C* 10.

4. Four men traded with a stock of 800 dollars, by which they gained 307 dols. A's stock was 140 dols. B's 260 dols. C's 300 dols. I demand D's stock and what each man gained by trading?

Ans. D's stock was $100, *and A gained* $53, *72cts 5m.* *B* $99, *77½cts.* *C* $115, *12½cts. and D* $38, *37½cts.*

5. A bankrupt is indebted to A 211*l.* to B 300*l* and to C 391*l.* and his whole estate amounts only to 675*l.* 10*s.* which he gives up to these creditors; how much must each have in proportion to his debt?

Ans. A must have £158 0*s.* 3¾*d.* *B* £224 13*s.* 4¼*d. and* *C* £292 16*s.* 3¾*d.*

6. A captain, mate and 20 seamen took a prize worth 3501 dols. of which the captain takes 11 shares, and the mate 5 shares; the remainder of the prize is equally divided among the sailors; how much did each man receive?

		$	cts.
Ans.	The captain received	1069,	75
	The mate	486,	25
	Each sailor	97,	25

7. Divide the number of 360 into 3 parts, which shall be to each other as 2, 3 and 4. *Ans.* 80, 120 *and* 160.

8. Two merchants have gained 450*l.* of which A is to have 3 times as much as B; how much is each to have?
Ans. A £337 10s. *and B* £112 10s.—1+3=4 : 450 : : 3 : £337 10s. *A's share.*

9. Three persons are to share 600*l.* A is to have a certain sum, B as much again as A, and C three times as much as B. I demand each man's part?
Ans. A £$66\frac{6}{9}$, *B* £$133\frac{3}{9}$, *and C.* £400

10. A and B traded together and gained 100 dols. A put in 640 dols. B put in so much that he must receive 60 dols. of the gain; I demand B's stock? *Ans.* $960

11. A, B and C traded in company: A put in 140 dols. B 250 dols. and C put in 120 yds. of cloth, at cash price; they gained 230 dols. of which C took 100 dols. for his share of the gain: how did C value his cloth per yard in common stock, and what was A and B's part of the gain?
Ans. C put in the cloth at $2½ *per yard. A gained* $46, 66*cts.* 6*m.*+ *and B* $83, 33*cts.* 3*m.*+

COMPOUND FELLOWSHIP,

OR Fellowship with time, is occasioned by several shares of partners being continued in trade an unequal term of time.

RULE.

Multiply each man's stock or share by the time it was continued in trade: then,

As the sum of the several products,
Is to the whole gain or loss;
So is each man's particular product,
To his particular share of the gain or loss.

EXAMPLES.

1. A, B and C hold a pasture in common, for which they pay 19*l.* per annum. A put in 8 oxen for 6 weeks; B 12 oxen for 8 weeks; and C 12 oxen for 12 weeks; what must each pay of the rent?

$$\left.\begin{array}{r}8\times6=48\\12\times8=96\\12\times12=144\\ \hline \text{Sum }288\end{array}\right\}\text{As }288:19l.::\left\{\begin{array}{lrrrl} & £. & s. & d. & \\ 48: & 3 & 3 & 4 & \text{A's pt.}\\ 96: & 6 & 6 & 8 & \text{B's —}\\ 144: & 9 & 10 & 0 & \text{C's —}\\ \hline \text{Proof} & 19 & 0 & 0 & \end{array}\right.$$

2. Two merchants traded in company; A put in 215 dols. for 6 months, and B 390 dols. for 9 months, but by misfortune they lose 200 dols.; how must they share the loss? *Ans. A's loss* $53, *75cts. B's* $146, *25cts.*

3. Three persons had received 665 dols. interest: A had put in 4000 dols. for 12 months, B 3000 dols. for 15 months, and C 5000 dols. for 8 months; how much is each man's part of the interest?

Ans. A $240, *B* $225 *and C* $200

4. Two partners gained by trading 110*l.* 12s.: A's stock was 120*l.* 10s. for 4 months, and B's 200*l.* for 6½ months; what is each man's part of the gain?

Ans. A's part £29 18*s.* 3½*d.*$\frac{1356}{1782}$. *B's* £80 13*s.* 8¼*d.*$\frac{426}{1782}$.

5. Two merchants enter into partnership for 18 months. A at first put into stock 500 dollars, and at the end of 8 months he put in 100 dollars more; B at first put in 800 dollars, and at 4 month's end took out 200 dols. At the expiration of the time they find they have gained 700 dollars; what is each man's share of the gain?

$$\textit{Ans.}\left\{\begin{array}{l}\$324,\ 07\ 4+\textit{A's share.}\\ \$375,\ 92\ 5+\textit{B's.}\quad \text{do}\end{array}\right.$$

6. A and B companied; A put in the first of January, 1000 dols.; but B could not put in any till the first of May; what did he then put in to have an equal share with A at the year's end?

$$\begin{array}{lllll} & \textit{Mo.} & \$ & \textit{Mo.} & \$\\ \text{As} & 12: & 1000:: & 8: & \dfrac{1000\times12}{8}=1500\ \textit{Ans.}\end{array}$$

DOUBLE RULE OF THREE.

THIS Rule teaches to resolve at once such questions as require two or more statings in simple proportion, whether direct or inverse.

In this rule there are always five terms given to find a sixth; the three first terms of which are a supposition, the two last a demand.

RULE.

In stating the question, place the terms of the supposition so that the principal cause of loss, gain or action possess the first place; that which signifies time, distance of place, &c. in the second place; and the remaing term in the third place. Place the terms of demand, under those of the same kind in the supposition. If the blank place or term sought, fall under the third term, the pro proportion is direct; then multiply the first and second terms together for a divisor, and the other three for a dividend: but if the blank fall under the first or second term, the proportion is inverse; then multiply the third and fourth terms together for a divisor, and the other three for a dividend, and the quotient will be the answer.

EXAMPLES.

1. If 7 men can build 36 rods of wall in 3 days; how many rods can 20 men build in 14 days?

7 : 3 : : 36 Terms of supposition.
20 : 14 Terms of demand.

```
     36
     --
     84
     42
     --
    504
     20
   -----
7×3=21)10080(480 rods. Ans.
```

2. If 100*l.* principal will gain 6*l.* interest in 12 months, what will 400*l.* gain in 7 months?

Principal 100*l.* : 12*mo.* : : 6*l.* Int.
400 : 7 - *Ans.* 14*l.*

3. If 100*l.* will gain 6*l.* a year; in what time will 400*l.* gain 14*l.*

£. *mo.* £.
100 : 12 : : 6
400 : : : 14 *Ans.* 7 *months.*

4. If 400*l.* gain 14*l.* in 7 months; what is the rate per cent. per annum?

£. *mo.* *Int.*
400 : 7 : : 14
100 : 12 *Ans.* £6.

5. What Principal at 6*l.* per cent. per annum, will gain 14*l.* in 7 months?

£. *mo.* *Int.*
100 : 12 : : 6
7 : : 14 *Ans.* £400

6. An usurer put out 86*l.* to receive interest for the same; and when it had continued 8 months, he received principal and interest, 88*l.* 17s. 4d.; I demand at what rate per cent. per ann. he received interest? *Ans.* 5 *per ct.*

7. If 20 bushels of wheat are sufficient for a family of 8 persons 5 months, how much will be sufficient for 4 persons 12 months? *Ans.* 24 *bushels.*

8. If 30 men perform a piece of work in 20 days; how many men will accomplish another piece of work 4 times as large in a fifth part of the time?

30 : 20 : : 1
4 : : 4 *Ans.* 600.

9. If the carriage of 5 cwt. 3 qrs. 150 miles, cost 24 dollars 58 cents; what must be paid for the carriage of 7 cwt. 2 qrs. 25 lb. 64 miles at the same rate?

Ans. $14, 08*cts.* 6*m.*+

10. If 8 men can build a wall, 20 feet long, 6 feet high and 4 feet thick, in 12 days; in what time will 24 men build one 200 feet long, 8 feet high, and 6 feet thick?

$$\begin{array}{lll} 8 : 12 : : & 20\times6\times4 & \\ \hline 24 : & 200\times8\times6 & 80 \textit{ days, Ans.} \end{array}$$

CONJOINED PROPORTION,

Is when the coins, weights or measures of several countries are compared in the same question; or it is joining many proportions together, and by the relation which several antecedents have to their consequents, the proportion between the first antecedent and the last consequent is discovered, as well as the proportion between the others in their several respects.

NOTE.—This rule may generally be abridged by cancelling equal quantities, or terms that happen to be the same in both columns: and it may be proved by as many statings in the Single Rule of Three as the nature of the question may require.

CASE I.

When it is required to find how many of the first sort of coin, weight or measure, mentioned in the question, are equal to a given quantity of the last.

RULE.

Place the numbers alternately, beginning at the left hand, and let the last number stand on the left hand column; then multiply the left hand column continually for a dividend, and the right hand for a divisor, and the quotient will be the answer.

EXAMPLES.

1. If 100 lb. English make 95 lb. Flemish, and 19 lb. Flemish 25 lb. at Bologna; how many pounds English are equal to 50 lb. at Bologna?

lb. *lb.*
100 Eng.=95 Flemish.
19 Fle. =25 Bologna?
50 Bologna. Then 95×25=2375 the divisor.

95000 dividend, and 2375)95000(40 *Ans.*

2. If 40 lb. at New-York make 48 lb. at Antwerp, and 30 lb. at Antwerp make 36 lb. at Leghorn; how many lb. at New-York are equal to 144 lb. at Leghorn?

Ans. 100*lb.*

3. If 70 braces at Venice be equal to 75 braces at Leghorn, and 7 braces at Leghorn be equal to 4 American yards; how many braces at Venice are equal to 64 American yards? *Ans.* $104\frac{8}{15}$.

CASE II.

When it is required to find how many of the last sort of coin, weight or measure, mentioned in the question, are equal to a given quantity of the first.

RULE.

Place the numbers alternately, beginning at the left hand, and let the last number stand on the right hand; then multiply the first row for a divisor, and the second for a dividend.

EXAMPLES.

1. If 24 lb. at New-London make 20 lb. at Amsterdam, and 50 lb. at Amsterdam 60 lb. at Paris; how many at Paris are equal to 40 at New-London?

Left. *Right.*
24 = 20 $20 \times 60 \times 40 = 48000$
50 = 60 ———————— = 40 *Ans.*
40 $24 \times 50 = 1200$

2. If 50 lb. at New-York make 45 at Amsterdam, and 80 lb. at Amsterdam make 103 at Dantzic; how many lb. at Dantzic are equal to 240 at N. York? *Ans.* $278\frac{1}{10}$

3. If 20 braces at Leghorn be equal to 11 vares at Lisbon, and 40 vares at Lisbon to 80 braces at Lucca; how many braces at Lucca are equal to 100 braces at Leghorn? *Ans.* 110.

EXCHANGE.

By this rule merchants know what sum of money ought to be received in one country, for any sum of different specie paid in another, according to the given course of exchange.

To reduce the monies of foreign nations to that of the United States, you may consult the following

TABLE:

Shewing the value of the monies of account, of foreign nations, estimated in Federal Money.*

	$	cts.
Pound Sterling of Great-Britain,	4	44
Pound Sterling of Ireland,	4	10
Livre of France,	0	$18\frac{1}{2}$
Guilder or Florin of the U. Netherlands,	0	39
Mark Banco of Hamburgh,	0	$33\frac{1}{3}$
Rix Dollar of Denmark,	1	0

---

*Laws U. S. A.

Rial Plate of Spain,	0 10
Milrea of Portugal,	1 24
Tale of China,	1 48
Pagoda of India,	1 94
Rupee of Bengal,	0 55½

I. OF GREAT BRITAIN.

EXAMPLES.

1. In 45*l.* 10s. sterling, how many dollars and cents?

A pound sterling being=444 cents,

Therefore—As 1*l.* : 444*cts.* : : 45,5*l.* : 20202*cts.* *Ans.*

2. In 500 dollars how many pounds sterling?

As 444*cts.* : 1*l.* : : 50000*cts.* : 112*l.* 12s. 3d.+ *Ans.*

II. OF IRELAND.

EXAMPLES.

1. In 90*l.* 10s. 6d. Irish money, how many cents?

1*l.* Irish=410*cts.*

£. *cts.* £. *cts.* $ *cts.*
Therefore—As 1 : 410 : : 90,525 : 37115¼=371, 15¼

2. In 168 dols. 10 cts. how many pounds Irish?

As 410*cts.* : 1*l.* : : 16810*cts.* : £41 Irish. *Ans.*

III. OF FRANCE.

Accounts are kept in livres, sols and deniers.

12 deniers, or pence, make 1 sol, or shilling,
20 sols, or shillings, — 1 livre, or pound.

EXAMPLES.

1. In 250 livres, 8 sols, how many dollars and cents?

1 livre of France=18½ cts. or 185 mills.

£. *m.* £. *m.* $. *cts. m.*
As 1 : 185 : : 250,4 : 46324=46, 32 4 *Ans.*

2. Reduce 87 dols. 45 cts. 7 m. into livres of France.

mills. liv. mills. liv. so. den.
As 185 : 1 : : 87457 : 472 14 9+ *Ans.*

IV. OF THE U. NETHERLANDS.

Accounts are kept here in guilders, stivers, groats and phennings.

8 phennings make 1 groat.
2 groats — 1 stiver.
20 stivers — 1 guilder, or florin.

A guilder is=39 cents, or 390 mills.

EXAMPLES.

Reduce 124 guilders, 14 stivers, into federal money.

Guil. cts. Guil. $ *d. c. m.*
As 1 : 39 : : 124,7 : 48, 6 3 3 *Ans.*
mills. G. mills. G.
As 390 : 1 : : 48633 : 124,7 *Proof*

V. OF HAMBURGH, IN GERMANY.

Accounts are kept in Hamburgh in marks, sous and deniers-lubs, and by some in rix dollars.

12 deniers-lubs make 1 sous-lubs.
16 sous-lubs, — 1 mark-lubs.
3 mark-lubs, — 1 rix-dollar.

NOTE.—A mark is = 33$\frac{1}{3}$ cts. or just $\frac{1}{3}$ of a dollar.

RULE.

Divide the marks by 3, the quotient will be dollars.

EXAMPLES.

Reduce 641 marks, 8 sous, to federal money.

3)641,5

$213,833 *Ans.*

But to reduce Federal Money into Marks, multiply the given sum by 3, &c.

EXAMPLES.

Reduce 121 dollars, 90 cts. into marks banco.

121,90
3

365,70=365 marks 11 sous, 2,4 den. *Ans.*

VI. OF SPAIN.

Accounts are kept in Spain in piastres, rials and marvadies.

34 marvadies of plate make 1 rial of plate.
8 rials of plate — 1 piastre or piece of 8.

To reduce rials of plate to Federal Money.

Since a rial of plate is = 10 cents, or 1 dime, you need only call the rials so many dimes, and it is done.

EXAMPLES.

485 rials=485 dimes,=48 dols. 50 cts. Ans.

But to reduce cents into rials of plate, divide by 10—Thus, 845 cents÷10=84,5=84 rials, 17 marvadies, &c.

VII. OF PORTUGAL.

Accounts are kept throughout this kingdom in milreas, and reas, reckoning 1000 reas to a milrea.

Note.—A milrea is = 124 cents; therefore to reduce milreas into Federal Money, multiply by 124, and the product will be cents, and decimals of a cent.

EXAMPLES.

1. In 340 milreas how many cents?
   340×124=42160 cents,=$421, 60*cts.* *Ans.*
2. In 211 milreas, 48 reas, how many cents?

Note.—When the reas are less than 100, place a cypher before them.—Thus 211,048×124=26169,952cts. or 261 dols. 69 cts. 9 mills.+ *Ans.*

But to reduce cents into milreas, divide them by 124; and if decimals arise you must carry on the quotient as far as three decimal places; then the whole numbers thereof will be the milreas, and the decimals will be the reas.

EXAMPLES.

1. In 4195 cents, how many milreas?
   4195÷124=33,830+or 33 *milreas*, 330 *reas*. *Ans.*
2. In 24 dols. 92 cts. how many milreas of Portugal?
   Ans. 20 *milreas*, 096 *reas*.

VIII. EAST-INDIA MONEY.

To reduce India Money to Federal, viz.

Tales of China, multiply with	148
Pagodas of India,	194
Rupee of Bengal,	55½

EXAMPLES.

1. In 641 Tales of China, how many cents?
   Ans. 94868.
2. In 50 Pagodas of India, how many cents?
   Ans. 9700.
3. In 98 Rupees of Bengal, how many cents?
   Ans. 5439.

VULGAR FRACTIONS.

HAVING briefly introduced Vulgar Fractions immediately after reduction of whole numbers, and given some general definitions, and a few such problems therein as were necessary to prepare and lead the scholar immediately to decimals; the learner is therefore requested to read those general definitions in page 74.

Vulgar Fractions are either proper, improper, single, compound, or mixed.

1. A single, simple, or proper fraction, is when the numerator is less than the denominator, as $\frac{1}{2}$ $\frac{3}{4}$ $\frac{2}{5}$ $\frac{16}{23}$, &c.

2. An *Improper Fraction*, is when the numerator exceeds the denominator, as $\frac{8}{3}$ $\frac{7}{5}$ $\frac{12}{4}$, &c.

3. A *Compound Fraction*, is the fraction of a fraction, coupled by the word of, thus, $\frac{2}{3}$ of $\frac{1}{12}$, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$, &c.

4. A *Mixed Number*, is composed of a whole number and a fraction, thus, $8\frac{1}{3}$, $14\frac{9}{12}$, &c.

5. Any whole number may be expressed like a fraction by drawing a line under it, and putting 1 for denominator, thus, $8 = \frac{8}{1}$, and 12 thus, $\frac{12}{1}$, &c.

6. The common measure of two or more numbers, is that number which will divide each of them without a remainder; thus, 3 is the common measure of 12, 24 and 30; and the greatest number which will do this, is called the greatest common measure.

7. A number, which can be measured by two or more numbers, is called their *common multiple*: and if it be the least number that can be so measured, it is called the *least common multiple*: thus, 24 is the common multiple of 2, 3 and 4; but their least common multiple is 12.

To find the least common multiple of two or more numbers.

RULE.

1. Divide by any number that will divide two or more of the given numbers without a remainder, and set the quotients, together with the undivided numbers, in a line beneath.

2. Divide the second lines as before, and so on till there are no two numbers that can be divided; then the

continued product of the divisors and quotients, will give the multiple required.

EXAMPLES.

1. What is the least common multiple of 4, 5, 6 and 10?

Operation,

$$\begin{array}{rrrrr} \times 5) & 4 & 5 & 6 & 10 \\ \hline \times 2) & 4 & 1 & 6 & 2 \\ \hline & \times 2 & 1 & \times 3 & 1 \\ \hline \end{array}$$

$5 \times 2 \times 2 \times 3 = 60$ *Ans.*

2. What is the least common multiple of 6 and 8?
Ans. 24.

3. What is the least number that 3, 5, 8 and 12 will measure? *Ans.* 120.

4. What is the least number that can be divided by the 9 digits separately, without a remainder? *Ans.* 2520.

REDUCTION OF VULGAR FRACTIONS,

IS the bringing them out of one form into another, in order to prepare them for the operation of Addition, Subtraction, &c.

CASE I.

To abbreviate or reduce fractions to their lowest terms.

RULE.

1. Find a common measure, by dividing the greater term by the less, and this divisor by the remainder, and so on, always dividing the last divisor by the last remainder, till nothing remains; the last divisor is the common measure.*

2. Divide both of the terms of the fraction by the common measure, and the quotients will make the fraction required.

---

* To find the greatest common measure of more than two numbers, you must find the greatest common measure of two of them as per rule above; then, of that common measure and one of the other numbers, and so on through all the numbers to the last; then will the greatest common measure *last found* be the answer.

Or, If you chuse, you may take that easy method in Problem 1. (page 74.)

EXAMPLES.

1. Reduce $\frac{48}{56}$ to its lowest terms.

Operation.

```
48)56(1
   48
   08)48(6
      48
      00  Rem.
```

common mea. $8)\frac{48}{56}=\frac{6}{7}$ *Ans.*

2. Reduce $\frac{72}{94}$ to its lowest terms. *Ans.* $\frac{36}{47}$
3. Reduce $\frac{182}{196}$ to its lowest terms. *Ans.* $\frac{13}{14}$
4. Reduce $\frac{3798}{7596}$ to its lowest terms. *Ans.* $\frac{1}{2}$

CASE II.

To reduce a mixed number to its equivalent improper fraction.

RULE.

Multiply the whole number by the denominator of the given fraction, and to the product add the numerator, this sum written above the denominator will form the fraction required.

EXAMPLES.

1. Reduce $45\frac{7}{8}$ to its equivalent improper fraction.
$45\times8+7=\frac{367}{8}$ *Ans.*
2. Reduce $19\frac{12}{18}$ to its equivalent improper fraction.
Ans. $\frac{354}{18}$
3. Reduce $16\frac{18}{100}$ to an improper fraction.
Ans. $\frac{1618}{100}$
4. Reduce $61\frac{125}{360}$ to its equivalent improper fraction.
Ans. $\frac{22085}{360}$

CASE III.

To find the value of an improper fraction.

RULE.

Divide the numerator by the denominator, and the quotient will be the value sought.

EXAMPLES.

1. Find the value of $\frac{48}{5}$ — $5)48(9\frac{3}{5}$ *Ans.*
2. Find the value of $\frac{354}{18}$ — *Ans.* $19\frac{12}{18}$
3. Find the value of $\frac{933}{11}$ — *Ans.* $84\frac{9}{11}$
4. Find the value of $\frac{22085}{360}$ — *Ans.* $61\frac{125}{360}$
5. Find the value of $\frac{72}{9}$ — *Ans.* [illegible]

CASE IV.

To reduce a whole number to an equivalent fraction, having a given denominator.

RULE.

Multiply the whole number by the given denominator; place the product over the said denominator, and it will form the fraction required.

EXAMPLES.

1. Reduce 7 to a fraction whose denominator shall be 9.

Thus, $7\times9=63$, and $\frac{63}{9}$ *the Ans.*

2. Reduce 18 to a fraction whose denominator shall be 12. *Ans.* $\frac{216}{12}$

3. Reduce 100 to its equivalent fraction, having 90 for a denominator. *Ans.* $\frac{9000}{90}=\frac{900}{9}=\frac{100}{1}$

CASE V.

To reduce a compound fraction to a simple one of equal value.

RULE.

1. Reduce all whole and mixed numbers to their equivalent fractions.

2. Multiply all the numerators together for a new numerator, and all the denominators for a new denominator; and they will form the fraction required.

EXAMPLES.

1. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{10}$ to a simple fraction.

$$\frac{1\times2\times3\times4}{2\times3\times4\times10}=\frac{24}{240}=\frac{1}{10}\ \textit{Ans.}$$

2. Reduce $\frac{5}{9}$ of $\frac{4}{8}$ of $\frac{3}{4}$ to a single fraction. *Ans.* $\frac{60}{288}$

3. Reduce $\frac{4}{5}$ of $\frac{11}{12}$ of $\frac{19}{25}$ to a single fraction. *Ans.* $\frac{836}{1500}$

4. Reduce $\frac{3}{4}$ of $\frac{5}{9}$ of 8 to a simple fraction. *Ans.* $\frac{120}{36}=3\frac{1}{3}$

5. Reduce $\frac{5}{6}$ of $\frac{12}{20}$ $42\frac{1}{5}$ to a simple fraction. *Ans.* $\frac{12660}{600}=21\frac{1}{10}$

Note.—If the denominator of any member of a compound fraction be equal to the numerator of another member thereof, they may both be expunged, and the other members continually multiplied (as by the rule) will produce the fraction required in lower terms.

6. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{7}$ to a simple fraction.

$$\text{Thus } \frac{2\times5}{4\times7}=\frac{10}{28}=\frac{5}{14}\ \textit{Ans.}$$

7. Reduce $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{11}{12}$ to a simple fraction.

Ans. $\frac{33}{72}=\frac{11}{24}$

CASE VI.

To reduce fractions of different denominations to equivalent fractions having a common denominator.

RULE I.

1. Reduce all fractions to simple terms.

2. Multiply each numerator into all the denominators except its own, for a new numerator: and all the denominators into each other continually for a common denominator; this written under the several new numerators will give the fractions required.

EXAMPLES.

1. Reduce $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ to equivalent fractions, having a common denominator.

$$\frac{1}{2}+\frac{2}{3}+\frac{3}{4}=24 \text{ common denominator.}$$

$$\begin{array}{lll}
1 & 2 & 3 \\
\times3 & 2 & 3 \\
\hline
3 & 4 & 9 \\
\times4 & 4 & 2 \\
\hline
12 & 16 & 18 \text{ new numerators.} \\
\hline
24 & 24 & 24 \text{ denominators.}
\end{array}$$

2. Reduce $\frac{7}{8}$ $\frac{9}{10}$ and $\frac{11}{12}$ to a common denominator.

Ans. $\frac{840}{960}$ $\frac{864}{960}$ *and* $\frac{880}{960}$

3. Reduce $\frac{1}{2}$ $\frac{2}{3}$ $\frac{5}{6}$ and $\frac{7}{8}$ to a common denominator.

Ans. $\frac{144}{288}$ $\frac{192}{288}$ $\frac{240}{288}$ *and* $\frac{252}{288}$

4. Reduce $\frac{4}{5}$ $\frac{6}{20}$ and $\frac{4}{10}$ to a common denominator.

$$\frac{800}{1000}\quad\frac{300}{1000}\ \text{and}\ \frac{400}{1000}=\frac{8}{10}\ \frac{8}{10}\ \text{and}\ \frac{4}{10}=1\frac{5}{10}$$ *Ans.*

5. Reduce $\frac{3}{4}$ $\frac{5}{6}$ and $12\frac{1}{3}$ to a common denominator.

Ans. $\frac{54}{72}$ $\frac{60}{72}$ $\frac{888}{72}$

6. Reduce $\frac{2}{9}$ $\frac{3}{4}$ and $\frac{5}{8}$ of $\frac{11}{12}$ to a common denominator.

Ans. $\frac{768}{3456}$ $\frac{2592}{3456}$ $\frac{1980}{3456}$

The foregoing is a general Rule for reducing fractions to a common denominator; but as it will save much labour to keep the fractions in the lowest terms possible, the following Rule is much preferable.

RULE II.

For reducing fractions to the least common denominator.

(By Rule, page 155) find the least common multiple of all the denominators of the given fractions, and it will be the common denominator required, in which divide each particular denominator, and multiply the quotient by its own numerator for a new numerator, and the new numerators being placed over the common denominator, will express the fractions required in their lowest terms.

EXAMPLES.

1. Reduce $\frac{1}{2}$ $\frac{3}{4}$ and $\frac{5}{8}$ to their least common denominator.

4)2 4 8
2)2 1 2
1 1 1 4×2=8 the least com. denominator.

8÷2×1=4 the 1st. numerator.
8÷4×3=6 the 2d. numerator.
8÷8×5=5 the 3d. numerator.

These numbers placed over the denominator, give the answer $\frac{4}{8}$ $\frac{6}{8}$ $\frac{5}{8}$ equal in value, and in much lower terms than the general Rule, which would produce ~~32 48 40~~ 64

2. Reduce $\frac{3}{8}$ $\frac{6}{9}$ and $\frac{7}{12}$ to their least common denominator.

Ans. 32 48 40
72 72 72

3. Reduce $\frac{1}{2}$ $\frac{3}{8}$ $\frac{2}{3}$ and $\frac{8}{12}$ to their least common denominator. *Ans.* [redacted] 12, 9, 16 / 24

4. Reduce $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{8}$ and $\frac{9}{16}$ to their least common denominator. *Ans.* [redacted] [illegible] / 16

CASE VII.

To reduce the fraction of one denomination to the fraction of another, retaining the same value.

RULE.

Reduce the given fraction to such a compound one, as will express the value of the given fraction, by comparing it with all the denominations between it and that denomination you would reduce it to; lastly, reduce this compound fraction to a single one, by Case V.

EXAMPLES.

1. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.
By comparing it, it becomes $\frac{5}{6}$ of $\frac{1}{12}$ of $\frac{1}{20}$ of a pound.

$$\frac{5 \times 1 \times 1}{6 \times 12 \times 20} = \frac{5}{1440} \text{ Ans.}$$

2. Reduce $\frac{5}{1440}$ of a pound to the fraction of a penny.
Compared thus, $\frac{5}{1440}$ of $\frac{20}{1}$ of $\frac{12}{1}$ d.
Then

$$\frac{5}{440} \times \frac{20}{1} \times \frac{12}{1} = \frac{1200}{1440} = \frac{5}{6}$$

3. Reduce $\frac{1}{2}$ of a farthing to the fraction of a shilling
Ans. $\frac{1}{96}$ s. 96 96

4. Reduce $\frac{2}{9}$ of a shilling to the fraction of a pound.
Ans. $\frac{2}{180} = \frac{1}{90}$

5. Reduce $\frac{5}{7}$ of a pwt. to the fraction of a pound troy.
Ans. $\frac{5}{1680} = \frac{1}{336}$

6. Reduce $\frac{8}{9}$ of a pound avoirdupois to the fraction of a cwt. *Ans.* $\frac{1}{126}$ *cwt.*

7. What part of a pound avoirdupois is $\frac{1}{126}$ of a cwt.
Compounded thus, $\frac{1}{126}$ of $\frac{4}{1}$ of $\frac{28}{1} = \frac{112}{126} = \frac{8}{9}$ *Ans.*

8. What part of an hour is $\frac{1}{224}$ of a week.
Ans. $\frac{168}{224} = \frac{3}{4}$

9. Reduce $\frac{3}{4}$ of a pint to the fraction of a hhd.
Ans. $\frac{1}{672}$

10. R[illegible] $\frac{4}{5}$ of a pound to the fraction of a guinea.
Compounded thus, $\frac{4}{5}$ of $\frac{20}{1}$ of $\frac{1}{28}$*s.* $=\frac{4}{7}$ *Ans.*

11. Express $5\frac{1}{2}$ furlongs in the fraction of a mile.
Thus, $5\frac{1}{2}=\frac{11}{2}$ of $\frac{1}{8}=\frac{11}{16}$ *Ans.*

12. Reduce $\frac{2}{5}$ of an English crown, at 6s. 8d. to the fraction of a guinea at 28s. *Ans.* $\frac{2}{21}$ *of a guinea.*

CASE VIII.

To find the value of the fraction in the known parts of the integer, as of coin, weight, measure, &c.

RULE.

Multiply the numerator by the parts in the next inferior denomination, and divide the product by the denominator; and if any thing remains, multiply it by the next inferior denomination, and divide by the denominator as before, and so on as far as necessary, and the quotient will be the answer.

NOTE.—This and the following Case are the same with Problems II. and III. pages 75 and 76; but for the scholar's exercise, I shall give a few more examples in each.

EXAMPLES.

1. What is the value of $\frac{211}{480}$ of a pound?
Ans. 8s. $9\frac{1}{2}$*d.*

2. Find the value of $\frac{7}{9}$ of a cwt.
Ans. 3*qrs.* 3*lb.* 1*oz.* $12\frac{4}{9}$*dr.*

3. Find the value of $\frac{7}{8}$ of 3s. 6d. *Ans.* 3s. $0\frac{3}{4}$*d.*

4. How much is $\frac{61}{128}$ of a pound avoirdupois?
Ans. 7*oz.* 10*dr.*

5. How much is $\frac{5}{7}$ of a hhd. of wine? *Ans.* 45 *gals.*

6. What is the value of $\frac{15}{16}$ of a dollar?
Ans. 5s. $7\frac{1}{2}$*d.*

7. What is the value of $\frac{9}{14}$ of a guinea? *Ans.* 18s.

8. Required the value of $\frac{107}{640}$ of a pound apothecaries.
Ans. 2*oz.* 3*grs.*

9. How much is $\frac{6}{7}$ of 5*l.* 9*s.*? *Ans.* £4 13*s.* $5\frac{1}{7}$*d.*

10. How much is $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of a hhd. of wine?
Ans. 15*gals.* 3*qts.*

CASE IX.

To reduce any given quantity to the fraction of any greater denomination of the same kind.
[See the Rule in Problem III. Page 75.]

EXAMPLES FOR EXERCISE.

1. Reduce 12 lb. 3 oz. to the fraction of a cwt.
Ans. $\frac{195}{1792}$

2. Reduce 13 cwt. 3 qrs. 20 lb. to the fraction of a ton.
Ans. $\frac{39}{56}$

3. Reduce 16s. to the fraction of a guinea. *Ans.* $\frac{4}{7}$

4. Reduce 1 hhd. 49 gals. of wine to the fraction of a tun. *Ans.* $\frac{4}{9}$.

5. What part of 4 cwt. 1 qr. 24 lb. is 3 cwt. 3 qrs. 17 lb. 8 oz. *Ans.* $\frac{7}{8}$

ADDITION OF VULGAR FRACTIONS.

RULE.

REDUCE compound fractions to single ones; mixed numbers to improper fractions; and all of them to their least common denominator (by Case VI. Rule II.) then the sum of the numerators written over the common denominator, will be the sum of the fractions required.

EXAMPLES.

1. Add $5\frac{1}{2}$ $\frac{3}{4}$ and $\frac{2}{3}$ of $\frac{7}{8}$ together.

$5\frac{1}{2}=\frac{11}{2}$ and $\frac{2}{3}$ of $\frac{7}{8}=\frac{14}{24}$

Then $\frac{11}{2}$ $\frac{3}{4}$ $\frac{14}{24}$ reduced to their least common denomina. by Case VI. Rule II. will become $\frac{132}{24}$ $\frac{18}{24}$ $\frac{14}{24}$

Then $132+18+14=\frac{164}{24}=6\frac{20}{24}$ or $6\frac{5}{6}$ *Answer.*

2. Add $\frac{2}{3}$ $\frac{5}{6}$ and $\frac{3}{8}$ together. *Ans.* $1\frac{7}{8}$
3. Add $\frac{1}{2}$ $\frac{3}{4}$ and $\frac{5}{8}$ together. *Ans.* $1\frac{7}{8}$
4. Add $12\frac{1}{2}$ $3\frac{2}{3}$ and $4\frac{3}{4}$ together. *Ans.* $20\frac{11}{12}$
5. Add $\frac{1}{3}$ of 95 and $\frac{7}{8}$ of $14\frac{1}{2}$ together. *Ans.* $44\frac{17}{48}$

Note 1.—In adding mixed numbers that are not compounded with other fractions, you may first find the sum of the fractions, to which add the whole numbers of the given mixed numbers.

6. Find the sum of $5\frac{3}{4}$ $7\frac{4}{5}$ and 15.

I find the sum of $\frac{3}{4}$ and $\frac{4}{5}$ to be $\frac{31}{20}=1\frac{11}{20}$

Then $1\frac{11}{20}+5+7+15=28\frac{11}{20}$ *Ans.*

7. Add $\frac{2}{5}$ and $17\frac{1}{2}$ together. *Ans.* $17\frac{9}{10}$
8. Add 25, $8\frac{1}{4}$ and $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{5}{10}$ *Ans.* $33\frac{5}{12}$

Note 2.—To add fractions of money, weight, &c. reduce fractions of different integers to those of the same.

Or, if you please you may find the value of each fraction by Case VIII. in reduction, and then add them in their proper terms.

9. Add $\frac{4}{7}$ of a shilling to $\frac{3}{8}$ of a pound.

1st Method.	2d Method.
$\frac{4}{7}$ of $\frac{1}{20}=\frac{4}{140}$£.	$\frac{3}{8}$£.=7s. 6d. 0qrs.
Then $\frac{4}{140}+\frac{3}{8}=\frac{452}{1120}$£.	$\frac{4}{7}$s. =0 6 $3\frac{3}{7}$
Whole value by Case VIII.	
is 8s. 0d. $3\frac{3}{7}$qrs. *Ans.*	*Ans.* 8 0 $3\frac{3}{7}$
	By Case VIII. Reduction.

10. Add $\frac{3}{5}$ lb. Troy, to $\frac{5}{9}$ of a pwt.

Ans. 7*oz.* 4*pwt.* $13\frac{1}{3}$*gr.*

11. Add $\frac{4}{7}$ of a ton, to $\frac{9}{10}$ of a cwt.

Ans. 12*cwt.* 1*qr.* 8*lb.* $12\frac{8}{10}$*oz.*

12. Add $\frac{3}{4}$ of a mile to $\frac{7}{10}$ of a furlong.

Ans. 6*fur.* 28*po.*

13. Add $\frac{2}{3}$ of a yard, $\frac{3}{4}$ of a foot, and [illegible] of a mile together. *Ans.* 1540*yds.* 2*ft.* 9*in.*

14. Add $\frac{1}{4}$ of a week, $\frac{1}{3}$ of a day, $\frac{1}{2}$ of an hour, and [illegible] of a minute together. *Ans.* 2*da.* 2*ho.* 30*min.* 45*sec.*

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SUBTRACTION OF VULGAR FRACTIONS.

RULE.*

PREPARE the fractions as in Addition, and the difference of the numerators written above the common denominator, will give the difference of the fraction required.

EXAMPLES.

1. From $\frac{3}{4}$ take $\frac{2}{3}$ of $\frac{7}{8}$

$\frac{2}{3}$ of $\frac{7}{8}=\frac{14}{24}=\frac{7}{12}$ Then $\frac{3}{4}$ and $\frac{7}{12}=\frac{\text{[illegible]}}{12}\ \frac{7}{12}$

Therefore $9-7=\frac{2}{12}=\frac{1}{6}$ *the Ans.*

2. From $\frac{25}{30}$ take $\frac{4}{7}$ *Answers.* $\frac{11}{42}$

3. From $\frac{11}{16}$ take $\frac{7}{13}$ $\frac{31}{208}$

4. From 14 take $\frac{13}{15}$ $13\frac{2}{15}$

5. What is the difference of $\frac{9}{14}$ and $\frac{17}{27}$? $\frac{5}{378}$

6. What differs $\frac{1}{19}$ from $\frac{1}{9}$? $\frac{10}{171}$

7. From $14\frac{1}{4}$ take $\frac{2}{3}$ of 19 $1\frac{7}{12}$

8. From $\frac{37}{80}$ take $\frac{111}{240}$ 0 *remains.*

9. From $\frac{11}{12}$ of a pound, take $\frac{5}{7}$ of a shilling.

$\frac{5}{7}$ of $\frac{1}{20}=\frac{5}{140}$£. Then from $\frac{11}{12}$£. take $\frac{5}{140}$£. *Ans.* $\frac{37}{42}$£.

NOTE.—In fractions of money, weight, &c. you may, if you please, find the value of the given fractions (by Case VIII. in Reduction) and then subtract them in their proper terms.

10. From $\frac{7}{13}$£. take $3\frac{7}{9}$ shilling. *Ans.* 5*s.* 6*d.* $2\frac{2}{3}$*qrs.*

11. From $\frac{3}{5}$ of an oz. take $\frac{7}{8}$ of a pwt.

Ans. 11*pwt.* 3*gr.*

12. From $\frac{1}{2}$ of a cwt. take $\frac{7}{12}$ of a lb.

Ans. 1*qr.* 27*lb.* 6*oz.* $10\frac{8}{12}$*dr.*

13. From $3\frac{2}{3}$ weeks, take $\frac{1}{7}$ of a day, and $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of an hour, *Ans.* 3*w.* 4*da.* 12*ho.* 19*min.* $17\frac{1}{7}$*sec*

---

*In subtracting mixed numbers, when the lower fraction is greater than the upper one, you may, without reducing them to improper fractions, subtract the numerator of the lower fraction from the common denominator, and to that difference add the upper numerator, carrying one to the unit's place of the lower whole number.

Also, a fraction may be subtracted from a whole number by taking the numerator of the fraction from its denominator, and placing the remainder over the denominator, then taking one from the whole number.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

REDUCE whole and mixed numbers to the improper fractions, mixed fractions to simple ones, and those of different integers to the same; then multiply all the numerators together for a new numerator, and all the denominators together for a new denominator.

EXAMPLES.

1.	Multiply $\frac{3}{8}$ by $\frac{4}{9}$.	*Answers.* $\frac{12}{72}=\frac{1}{6}$
2.	Multiply $\frac{5}{8}$ by $\frac{3}{7}$	$\frac{15}{56}$
3.	Multiply $5\frac{1}{4}$ by $\frac{1}{6}$	$\frac{7}{8}$
4.	Multiply $\frac{2}{3}$ of 7 by $\frac{4}{5}$	$3\frac{11}{15}$
5.	Multiply $\frac{128}{155}$ by $\frac{5}{12}$	$\frac{32}{93}$
6.	Multiply $\frac{3}{8}$ of 8 by $\frac{7}{8}$ of 5	$13\frac{1}{8}$
7.	Multiply $7\frac{1}{2}$ by $9\frac{1}{4}$	$69\frac{3}{8}$
8.	Multiply $\frac{2}{9}$ of $\frac{3}{5}$ by $\frac{7}{8}$ of $3\frac{3}{7}$	$\frac{12}{84}$

9. What is the continued product of $\frac{3}{4}$ of $\frac{2}{3}$, 7, $5\frac{1}{2}$ and $\frac{1}{3}$ of $\frac{5}{8}$? *Ans.* $4\frac{1}{96}$

* * *

DIVISION OF VULGAR FRACTIONS.

RULE.

PREPARE the fractions as before; then, invert the divisor and proceed exactly as in multiplication:—The products will be the quotient required.

EXAMPLES.

1. Divide $\frac{4}{7}$ by $\frac{3}{5}$ Thus, $\dfrac{4\times5}{3\times7}=\frac{20}{21}$ *Ans.*

2.	Divide $\frac{17}{21}$ by $\frac{3}{5}$	*Answers.* $1\frac{22}{63}$
3.	Divide $\frac{5}{8}$ of $\frac{4}{5}$ by $\frac{3}{5}$	$\frac{5}{6}$
4.	What is the quotient of 17 by $\frac{2}{7}$?	$59\frac{1}{2}$
5.	Divide 5 by $\frac{7}{10}$	$7\frac{1}{7}$
6.	Divide $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{7}{6}$ by $\frac{1}{6}$ of $\frac{3}{4}$	$3\frac{1}{9}$
7.	Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4	$2\frac{1}{20}$
8.	Divide 71 by 127	$\frac{71}{127}$
9.	Divide $5205\frac{1}{5}$ by $\frac{4}{5}$ of 91	$71\frac{1}{2}$

RULE OF THREE DIRECT IN VULGAR FRACTIONS.

RULE.

PREPARE the fractions as before, then state your question agreeable to the Rules already laid down in the Rule of Three in whole numbers, and invert the first term in the proportion; then multiply all the three terms continually together, and the product will be the answer, in the same name with the second or middle term.

EXAMPLES.

1. If $\frac{5}{8}$ of a yard cost $\frac{3}{7}$ of a pound, what will $\frac{9}{15}$ of an Ell English cost?

$\frac{5}{8}$yd. $= \frac{5}{8}$ of $\frac{4}{1}$ of $\frac{1}{5} = \frac{20}{40}$ or $\frac{1}{2}$ Ell English.

Ell. £. *Ell.* *s. d. qrs.*

As $\frac{1}{2} : \frac{3}{7} :: \frac{9}{15}$ And $\frac{2}{1} \times \frac{3}{7} \times \frac{9}{15} = \frac{54}{105}$£. $=$ 10 3 $1\frac{5}{7}$ *Ans.*

2. If $\frac{3}{5}$ of a yard cost $\frac{7}{8}$ of a pound, what will $40\frac{3}{4}$ yds. come to? *Ans.* £59 8*s.* $6\frac{1}{3}$*d.*

3. If 50 bushels of wheat cost $17\frac{3}{5}$*l.* what is it per bushel? *Ans.* 7*s.* 0*d.* $1\frac{23}{25}$*qrs.*

4. If a pistareen be worth $14\frac{2}{5}$ pence, what are 100 pistareens worth? *Ans.* £6

5. A merchant sold $5\frac{1}{2}$ pieces of cloth, each containing $24\frac{1}{3}$ yds. at 9*s.* $\frac{1}{2}$d. per yard; what did the whole amount to? *Ans.* £60 10*s.* 0*d.* $3\frac{3}{5}$*qrs.* 4/9

6. A person having $\frac{3}{5}$ of a vessel, sells $\frac{2}{3}$ of his share for 312*l.*; what is the whole vessel worth? *Ans.* £780

7. If $\frac{7}{8}$ of a ship be worth $\frac{3}{5}$ of her cargo, valued at 8000*l.* what is the whole ship and cargo worth? *Ans.* £10031 14*s.* $11\frac{1}{4}$*d.*

INVERSE PROPORTION.

RULE.

PREPARE the fractions and state the question as before, then invert the third term, and multiply all the three terms together, the product will be the answer.

EXAMPLES.

1. How much shalloon that is $\frac{3}{5}$ yard wide, will line $5\frac{1}{2}$ yards of cloth which is $1\frac{1}{4}$ yard wide?

Yds. yds. yds. *Yds.*

As $1\frac{3}{4} : 5\frac{1}{2} :: \frac{3}{5}$ And $\frac{7}{4}\times\frac{11}{2}\times\frac{5}{3}=\frac{385}{24}=16\frac{1}{24}$ *Ans.*

2. If a man perform a journey in $3\frac{1}{5}$ days, when the day is $12\frac{1}{3}$ hours long; in how many days will he do it when the day is but $9\frac{1}{2}$hours. 4 44 5 *Ans.* $\frac{44}{285}$ *days.*

3. If 13 men in $11\frac{2}{3}$days, mow $21\frac{1}{2}$ acres, in how many days will 8 men do the same. *Ans.* $18\frac{23}{24}$ *days.*

4. How much in length that is $7\frac{1}{3}$ inches broad, will make a square foot? *Ans.* [illegible] *inches.*

5. If $25\frac{2}{7}$s. will pay for the carriage of an cwt. $145\frac{1}{4}$ miles; how far may $6\frac{1}{2}$ cwt. be carried for the same money? *Ans.* $22\frac{9}{26}$ *miles.*

6. How many yards of baize which is $1\frac{1}{4}$ yards wide, will line $18\frac{7}{8}$ yards of camblet $\frac{3}{4}$ yd. wide?

Ans. 11*yds.* 1*qr.* $1\frac{1}{3}$ *na*

RULE OF THREE DIRECT IN DECIMALS.

RULE.

REDUCE your fractions to decimals, and state your question as in whole numbers; multiply the second and third together; divide by the first, and the quotient will be the answer, &c.

EXAMPLES.

1. If $\frac{7}{8}$ of a yd. cost $\frac{7}{12}$ of a pound; what will $15\frac{3}{4}$ yds. come to? $\frac{7}{8}$=,875 $\frac{7}{12}$=,583+and $\frac{3}{4}$=,75

Yds. £. *Yds.* £. £. *s. d. qrs.*

As ,875 : ,583 :: 15,75 : 10,494=10 9 10 2,24 Ans.

2. If 1 pint of wine cost 1,2s. what cost 12,5 hhds.?

Ans. £.378

3. If $4\frac{1}{4}$yds. cost 3s. $4\frac{1}{2}$d. what will $30\frac{5}{8}$ yds. cost?

Ans. £.1 4s 4d 2qrs. +

4. If 1,4 cwt. of sugar cost 10 dols. 9 cts. what will 9 cwt. 3 qrs. cost at the same rate?

cwt. $ *cwt.* $

As 1,4 : : 10,09 : : 9,75 : 70,269=$70, 26*cts.* 9*m.*+

5. If 19 yards cost 25,75 dols. what will 435½ yards come to? *Ans.* $590, 21*cts.* 7$\frac{2}{10}$*m.*

6. If 345 yards of tape cost 5 dols. 17 cents, 5m. what will 1 yard cost? *Ans.* ,015=1½*cts.*

7. If a man lays out 121 dols. 23 cts. in merchandize, and thereby gains 39,51 dols. how much will he gain in laying out 12 dollars at the same rate?

Ans. 3,91 *dols.*=$3, 91*cts.*

8. How many yards of ribbon can I buy for 25½ dols. if 29¾ yds. cost 4¼ dollars? *Ans.* 178½ *yards.*

9. If 178½ yds. cost 25½ dollars, what cost 29¾ yards?

Ans. $4¼

10. If 1,6 cwt. of sugar cost 12 dols. 12 cts. what cost 3 hhds. each 11 cwt. 3 qrs. 10,12 lb.?

Ans. 269,072 *dols.*=$269, 7*cts.* 2*m.*+

SIMPLE INTEREST BY DECIMALS.

A TABLE OF RATIOS.

Rate per cent.	*Ratio.*	*Rate per cent.*	*Ratio.*
3	,03	5½	,055
4	,04	6	,06
4½	,045	6½	,065
5	,05	7	,07

Ratio is the simple interest of 1*l.* for one year; or in federal money, of $1 for one year, at the rate per cent. agreed on.

RULE.

Multiply the Principal, Ratio and time continually together, and the last product will be the interest required.

EXAMPLES.

1. Required the interest of 211 dols. 45 cts. for 5 years, at 5 per cent. per annum?

```
     $ cts.
    211,45 Principal.
       ,05 Ratio.
   ---------
   10,5725 Interest for one year.
         5 Multiply by the time.
   ---------
   52,8625 Ans.=$52, 86cts. 2½m.
```

2. What is the interest of 645*l.* 10s. for 3 years, at 6 per cent. per annum?
£645,5×06×3=116,190=£116 3*s.* 9*d.* 2,4*qrs.* *Ans.*

3. What is the interest of 121*l.* 8s. 6d. for 4½ years, at 6 per cent. per annum? *Ans.* £32 15*s.* 8*d.* 1,36*qrs.*

4. What is the amount of 536 dollars 39 cents, for 1½ years at 6 per cent. per annum? *Ans.* $584,6651.

5. Required the amount of 648 dols. 50 cts. for 12¾ yrs. at 5½ per cent. per annum? *Ans.* $1103, 26*cts.*+

CASE II.

The amount, time and ratio given, to find the principal.

RULE.

Multiply the ratio by the time, add unity to the product for a divisor, by which sum divide the amount, and the quotient will be the principal.

EXAMPLES.

1. What principal will amount to 1235,975 dollars, in 5 years, at 6 per cent. per annum? $ $
,06×5+1=1,30)1235,975(950,75 *Ans.*

2. What principal will amount to 873*l.* 19s. in 9 years, at 6 per cent. per annum? *Ans.* £567 10*s.*

3. What principal will amount to 626 dols. 6 cts. in 12 years, at 7 per cent.? *Ans.* $340,25=$340, 25*cts.*

4. What principal will amount to 950*l.* 10s. 4,125d. in 8¾ years, at 5½ per cent.? *Ans.* £645 15*s.*

CASE III.

The amount, principal and time given, to find the ratio.

RULE.—Subtract the principal from the amount, divide the remainder by the product of the time and principal, and the quotient will be the ratio.

EXAMPLES.

1. At what rate per cent. will 950,75 dols. amount to 1235, 975 dols. in 5 years?

From the amount = 1235,975
Take the principal = 950,75

950,75×5=4753,75)285,2250(,06=6 per cent.
285,2250 *Ans.*

2. At what rate per cent. will 567*l.* 10s. amount to 873*l.* 19s. in 9 years? *Ans.* 6 *per cent.*

3. At what rate per cent. will 340 dols. 25 cts. amount to 626 dols. 6 cts. in 12 years? *Ans.* 7 *per cent.*

4. At what rate per cent. will 645*l.* 15s. amount to 956*l.* 10s. 4,125d. in 8¾ years? *Ans.* 5½ *per cent.*

CASE IV.

The amount, principal, and rate per cent. given, to find the time.

RULE.

Subtract the principal from the amount; divide the remainder by the product of the ratio and principal; and the quotient will be the time.

EXAMPLES.

1. In what time will 950 dols. 75 cts. amount to 1235 dollars, 97,5 cents, at 6 per cent. per annum?

From the amount $1235,975
Take the principal 950,75

950,75×06=57,0450)285,2250(5 *years, Ans.*
285,2250

2. In what time will 567*l.* 10s. amount to 873*l.* 19s. at 6 per cent. per annum? *Ans.* 9 *years.*

3. In what time will 340 dols. 25 cts. amount to 626 dols. 6 cents at 7 per cent. per annum? *Ans.* 12 *years.*

4. In what time will 645*l.* 15s. amount to 956*l.* 10s. 4,125d. at 5½ per ct. per annum? *Ans.* 8,75=8¾ *years.*

TO CALCULATE INTEREST FOR DAYS.

RULE.

Multiply the principal by the given number of days, and that product by the ratio; divide the last product by 365 (the number of days in a year) and it will give the interest required.

EXAMPLES.

1. What is the interest of 360*l.* 10s. for 146 days, at 6 per cent.?

£. £. s. d. grs.

$$\frac{360{,}5\times146\times{,}06}{365}=8652=8\ 13\ 0\ 1{,}9$$ *Ans.*

2. What is the interest of 640 dols. 60 cts. for 100 days at 6 per cent. per annum? *Ans.* $10,53*cts.*+

3. Required the interest of 250*l.* 17s. for 120 days at 5 per cent. per annum? *Ans.* £4,1235=4*l.* 2*s.* 5½*d.*+

4. Required the interest of 481 dollars 75 cents, for 25 days, at 7 per cent. per annum? *Ans.* $2,30*cts.* 9*m.*+

A TABLE, showing the number of Days from any day of one month to the same day of any other month.

	FROM ANY DAY OF											
	Jan.	*Feb.*	*Mar*	*Ap'l.*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov*	*Dec.*
Jan.	365	334	306	275	245	214	184	153	122	92	61	31
Feb.	31	365	337	306	276	245	215	184	153	123	92	62
Mar	59	28	365	334	304	273	243	212	181	151	120	90
Ap'l.	90	59	31	365	335	304	274	243	212	182	151	121
May	120	89	61	30	365	334	304	273	242	212	181	151
June	151	120	92	61	31	365	335	304	273	243	212	182
July	181	150	122	91	61	30	365	334	303	273	242	212
Aug.	212	181	153	122	92	61	31	365	334	304	273	243
Sept.	243	212	184	153	123	91	62	31	365	335	304	274
Oct.	273	242	214	183	153	122	92	61	30	365	334	304
Nov	304	273	246	214	184	153	123	92	61	31	365	335
Dec.	[illegible]	303	275	244	214	183	153	122	91	61	30	365

When interest is to be calculated on cash accounts, &c. where partial payments are made; multiply the several balances into the days they are at interest, then multiply the sum of these products by the rate on the dollar, and divide the last product by 365, and you will have the whole interest due on the account, &c.

EXAMPLES.

Lent Peter Trusty, per bill on demand, dated 1st of June, 1800, 2000 dollars, of which I received back the 19th of August, 400 dollars; on the 15th of October, 600 dollars; on the 11th of December, 400 dollars; on the 17th of February, 1801, 200 dollars; and on the 1st of June, 400 dollars; how much interest is due on the bill, reckoning at 6 per cent.?

1800,	*dolls.*	*days.*	*products*
June 1, Principal per bill,	2000	79	158000
August 19, Received in part,	400		
Balance,	1600	57	91200
October 15, Received in part,	600		
Balance,	1000	57	57000
December 11, Received in part,	400		
1801, Balance,	600	68	40800
February 17, Received in part,	200		
Balance,	400	104	41600
June 1, Rec'd in full of principal,	400		
			388600

Then 388600
,06 Ratio.

$ *cts.* *m.*
365)23316,00(63,879 *Ans.* = 63 87 9 +

The following Rule for computing interest on any note, or obligation, when there are payments in part, or endorsements, was established by the Superior Court of the State of Connecticut, in 1784.

RULE.

"Compute the interest to the time of the first payment; if that be one year or more from the time the interest commenced, add it to the principal, and deduct the payment from the sum total. If there be after payments made, compute the interest on the balance due to the next payment, and then deduct the payment as above; and in like manner from one payment to another, till all the payments are absorbed; provided the time between one payment and another be one year or more. But if any payment be made before one year's interest hath accrued, then compute the interest on the principal sum due on the obligation for one year, add it to the principal, and compute the interest on the sum paid, from the time it was paid, up to the end of the year; add it to the sum paid, and deduct that sum from the principal and interest added *as above.**

"If any payments be made of a less sum than the interest arisen at the time of such payment, no interest is to be computed but only on the principal sum for any period." *Kirby's Reports, page* 49.

EXAMPLES.

A bond, or note, dated January 4th, 1797, was given for 1000 dollars, interest at 6 per cent. and there were payments endorsed upon it as follows, viz.

	$
1st payment February 19, 1798.	200
2d payment June 29, 1799.	500
3d payment November 14, 1799	260

I demand how much remains due on said note the 24th of December, 1800?

1000,00 dated January 4, 1797.
67,50 Interest to February 19, 1798=13½ *months.*

1067,50 amount. [Carried up

---

*If a year does not extend beyond the time of final settlement; but if it does, then find the amount of the principal sum due on the obligation, up to the time of settlement, and likewise find the amount of the sum paid, from the time it was paid, up to the time of final settlement, and deduct this amount from the amount of the principal. But if there be several payments made within the said time, find the amount of the several payments, from the time they were paid, to the time of settlement, and deduct their amount from the amount of the principal.

1067,50 amount. [Brought up.
200,00 first payment deducted.

867,50 balance due, Feb. 19, 1798.
70,845 interest to June 29, 1799=16⅓ *months.*

938,345 amount.
500,000 second payment deducted.

438,345 balance due, June 29, 1799.
26,30 Interest for one year.

464,645 amount for one year.
269,750 amount of third payment for 7½ *months.**

194,895 balance due June 29, 1800. *mo. da.*
5,687 Interest to December 24, 1800. 5 25

200,579 balance due on the Note, Dec. 24, 1800.

RULE II.

Established by the Courts of Law in Massachusetts for computing interest on notes, &c. on which partial payments have been endorsed.

"Compute the interest on the principal sum, from the time when the interest commenced to the first time when a payment was made, which exceeds either alone or in conjunction with the preceding payment (if any) the interest at that time due: add that interest to the principal, and from the sum subtract the payment made at that time, together with the preceding payment (if any) and the remainder forms a new principal; on which compute and subtract the payments as upon the first principal, and proceed in this manner to the time of final settlement."

$ *cts.*
*260,00 *third payment with its interest from the time it*
9,75 *was paid, up to the end of the year, or from*
Nov. 14, 1799 to June 29, 1800, which is 7½ [months.
269,75 *amount.*

Let the foregoing example be solved by this Rule.

A note for 1000 dols. dated Jan. 4, 1797, at 6 per cent.

1st payment February 19, 1798.	$200
2d payment June 29, 1799.	500
3d payment November 14, 1799.	260

How much remains due on said note the 24th of December, 1800?

	$ *cts.*
Principal, January 4, 1797,	1000,00
Interest to Feb. 19, 1798, (13½ *mo.*)	67,50
Amount,	1067,50
Paid February 19, 1798,	200,00
Remainder for a new principal,	867,50
Interest to June 29, 1799, (16⅓ *mo.*)	70,84
Amount,	938,34
Paid June 29, 1799,	500,00
Remains for a new principal,	438,34
Interest to November 14, 1799, (4½ *mo.*)	9,86
Amount,	448,20
November 14, 1799, paid,	260,00
Remains a new principal,	188,20
Interest to December 24, 1800, (13½ *mo.*)	12,70
Balance due on said note, Dec. 24, 1800,	200,90

	$ *cts.*
The balance by Rule I.	200,579
By Rule II.	200,990
Difference,	0,411

Another Example in Rule II.

A bond or note, dated February 1, 1800, was given for 500 dollars, interest at 6 per cent. and there were payments endorsed upon it as follows, viz.

	$ *cts.*
1st payment May 1, 1800,	40,00
2d payment November 14, 1800,	8,00

3d payment April 1, 1801.	12,00
4th payment May 1, 1801.	30,00

How much remains due on said note the 16th of September, 1801?

		$ cts.
Principal dated February 1, 1800,		500,00
Interest to May 1, 1800, (3 *mo.*)		7,50
Amount,		507,50
Paid May 1, 1800, a sum exceeding the interest,		40,00
New principal, May 1, 1800,		467,50
Interest to May 1, 1801, (1 *year.*)		28,05
Amount,		495,55
Paid Nov. 4, 1800, a sum less than the interest then due,	8,00	
Paid April 1, 1801, do. do.	12,00	
Paid May 1, 1801, a sum greater,	30,00	
		50,00
New principal May 1, 1801,		445,55
Interest to Sept. 16, 1801, (4½ *mo.*)		10,02
Balance due on the note, Sept. 16, 1801,		$455,57

☞ *The payments being applied according to this Rule, keep down the interest, and no part of the interest ever forms a part of the principal carrying interest.*

* * *

COMPOUND INTEREST BY DECIMALS.

RULE.

MULTIPLY the given principal continually by the amount of one pound, or one dollar, for one year, at the rate per cent. given, until the number of multiplications are equal to the given number of years, and the product will be the amount required.

OR, In Table I. Appendix, find the amount of one dollar, or one pound, for the given number of years, which multiply by the given principal, and it will give the amount as before.

EXAMPLES.

1. What will 400*l.* amount to in 4 years, at 6 per cent. per annum, compound interest?

$400\times1{,}06\times1{,}06\times1{,}06\times1{,}06=$£$504{,}99+$ or
[£504 10*s.* 9*d.* 2,75*qrs.*+ *Ans.*

The same by Table I.
Tabular amount of £1=1,26247
Multiply by the principal 400

Whole amount=£504,98800

2. Required the amount of 425 dols. 75 cts. for 3 years, at 6 per cent. compound interest. *Ans.* $507,7½*cts.*+

3. What is the compound interest of 555 dols. for 14 years, at 5 per cent.? By Table I. *Ans.* $543,86*cts.*+

4. What will 50 dollars amount to in 20 years, at 6 per cent, compound interest? *Ans.* $160 35*cts.* 6½*m.*

INVOLUTION.

Is the multiplying any number with itself, and that product by the former multiplier; and so on; and the several products which arise are called powers.

The number denoting the height of the power, is called the index, or exponent of that power.

EXAMPLES.

What is the 5th power of 8.
8 the root or 1st power.
8
64 = 2d power, or square.
8
512 = 3d power, or cube.
8
4096 = 4th power, or biquadrate.
8
32768 = 5th power, or sursolid. *Ans.*

What is the square of 17,1 ? *Ans.* 292,41
What is the square of ,085 ? *Ans.* ,007225
What is the cube of 25,4 ? *Ans.* 16387,064
What is the biquadrate of 12 ? *Ans.* 20736
What is the square of $7\frac{1}{4}$? *Ans.* $52\frac{9}{16}$

EVOLUTION, OR EXTRACTION OF ROOTS.

WHEN the root of any power is required, the business of finding it is called the Extraction of the Root.

The root is that number, which by a continual multiplication into itself, produces the given power.

Although there is no number but what will pro[illegible]ce a perfect power by involution, yet there are many numbers of which precise roots can never be determined. But, by the help of decimals, we can approximate towards the root to any assigned degree of exactness.

The roots which approximate, are called surd roots, and those which are perfectly accurate are called rational roots.

A Table of the Squares and Cubes of the nine digits.

Roots.	1	2	3	4	5	6	7	8	9
Squares.	1	4	9	16	25	36	49	64	81
Cubes.	1	8	27	64	125	216	343	512	729

EXTRACTION OF THE SQUARE ROOT.

Any number multiplied into itself produces a square.

To extract the square root, is only to find a number, which being multiplied into itself, shall produce the given number.

RULE.

1. Distinguish the given number into periods of two figures each, by putting a point over the place of units, another over the place of hundreds, and so on; and if there are decimals, point them in the same manner, from units towards the right hand; which points show the number of figures the root will consist of.

2. Find the greatest square number in the first, or left

hand period, place the root of it at the right hand of the given number, (after the manner of a quotient in division) for the first figure of the root, and the square number under the period, and subtract it therefrom, and to the remainder bring down the next period for a dividend.

3. Place the double of the root, already found, on the left hand of the dividend for a divisor.

4. Place such a figure at the right hand of the divisor, and also the same figure in the root, as when multiplied into the whole (increased divisor) the product shall be equal to, or the next less than the dividend, and it will be the second figure in the root.

5. Subtract the product from the dividend, and to the remainder join the next period for a new dividend.

6. Double the figures already found in the root, for a new divisor, and from these find the next figure in the root as last directed, and continue the operation in the same manner, till you have brought down all the periods.

Or, to facilitate the foregoing Rule, when you have brought down a period, and formed a dividend, in order to find a new figure in the root, you may divide said dividend, (omitting the right hand figure thereof,) by double the root already found, and the quotient will commonly be the figures sought, or being made less one or two, will generally give the next figure in the quotient.

EXAMPLES.

1. Required the square root of 141225,64.

141225,64(375,8 the root exactly without a remainder; but when the periods belonging to any given number are exhausted, and still leave a remainder, the operation may be continued at pleasure, by annexing periods of cyphers, &c.

9

67)512
469

745)4525
3725

7508)60064
60064

0 remains.

	Answers.
2. What is the square root of 1296 ?	36
3. Of — 56644 ?	23,8
4. Of — 5499025 ?	2345
5. Of — 36372961 ?	6031
6. Of — 184,2 ?	13,57+
7. Of — 9712,693809 ?	98,553
8. Of — 0,45369 ?	,673+
9. Of — ,002916 ?	,054
10. Of — 45 ?	6,708+

TO EXTRACT THE SQUARE ROOT OF VULGAR FRACTIONS.

RULE.

Reduce the fraction to its lowest terms for this and all other roots; then

1. Extract the root of the numerator for the new numerator, and the root of the denominator, for a new denominator.

2. If the fraction be a surd, reduce it to a decimal, and extract its root.

EXAMPLES.

	Answers
1. What is the square root of $\frac{98}{162}$?	$\frac{7}{9}$
2. What is the square root of $\frac{225}{1024}$?	$\frac{15}{32}$
3. What is the square root of $\frac{112}{175}$?	$\frac{4}{5}$
4. What is the square root of $20\frac{1}{4}$?	$4\frac{1}{2}$
5. What is the square root of $248\frac{1}{16}$?	$15\frac{3}{4}$

SURDS.

6. What is the square root of $\frac{15}{18}$?	9128+
7. What is the square root of $\frac{42}{70}$?	,7745+
8. Required the square root of $36\frac{1}{4}$?	6,0207+

APPLICATION AND USE OF THE SQUARE ROOT.

Problem I. A certain General has an army of 5184 men; how many must he place in rank and file, to form them into a square?

RULE.

Extract the square root of the given number.

√5184=72 *Ans.*

PROB. II. A certain square pavement contains 20736 square stones, all of the same size; I demand how many are contained in one of its sides? √20736=144 *Ans.*

PROB. III. To find a mean proportional between two numbers.

RULE.

Multiply the given numbers together, and extract the square root of the product.

EXAMPLES.

What is the mean proportional between 18 and 72?

72×18=1296, and √1296=36 *Ans.*

PROB. IV. To form any body of soldiers so that they may be double, triple, &c. as many in rank as in file.

RULE.

Extract the square root of 1-2, 1-3, &c. of the given number of men, and that will be the number of men in file, which double, triple, &c. and the product will be the number in rank.

EXAMPLES.

Let 13122 men be so formed, as that the number in rank may be double the number in file.

13122÷2=6561, and √6561=81 *in file*, and 81×2 =162 *in rank.*

PROB. V. Admit 10 hhds. of water are discharged through a leaden pipe of 2½ inches in diameter, in a certain time; I demand what the diameter of another pipe must be, to discharge four times as much water in the same time.

RULE.

Square the given diameter, and multiply said square by the given proportion, and the square root of the product is the answer.

2½=2,5, and 2,5×2,5=6,25 square.
4 given proportion

√25,00=5 inch. diam. Ans.

Prob. VI. The sum of any two numbers, and their products being given, to find each number.

RULE.

From the square of their sum, subtract 4 times their product, and extract the square root of the remainder, which will be the difference of the two numbers; then half the said difference added to half the sum, gives the greater of the two numbers, and the said half difference subtracted from the half sum, gives the lesser number.

EXAMPLES.

The sum of two numbers is 43, and their product is 442; what are those two numbers?

The sum of the numb. 43×43=1849 square of d
The product of do. 442× 4=1768 4 times the pro.
Then to the ½ sum of 21,5 —— [numb.
+and— 4,5 √81=9 diff. of the
—— ——
Greatest number, 26,0 4½ the ½ diff.
—— *Answers.*
Least number, 17,0

EXTRACTION OF THE CUBE ROOT.

A cube is any number multiplied by its square.

To extract the cube root, is to find a number, which, being multiplied into its square, shall produce the given number.

RULE.

1. Separate the given number into periods of three figures each, by putting a point over the unit figure, and every third figure from the place of units to the left, and if there be decimals, to the right.

2. Find the greatest cube in the left hand period, and place its root in the quotient.

3. Subtract the cube thus found, from the said period, and to the remainder bring down the next period, calling this the dividend.

4. Multiply the square of the quotient by 300, calling *it the divisor.*

5. Seek how often the divisor may be had in the dividend, and place the result in the quotient; then multiply the divisor by this last quotient figure, placing the product under the dividend.

6. Multiply the former quotient figure, or figures by the square of the last quotient figure, and that product by 30, and place the product under the last; then under these two products place the cube of the last quotient figure, and add them together, calling their sum the subtrahend.

7. Subtract the subtrahend from the dividend, and to the remainder bring down the next period for a new dividend; with which proceed in the same manner, till the whole be finished.

NOTE.—If the subtrahend (found by the foregoing rule) happens to be greater than the dividend, and consequently cannot be subtracted therefrom, you must make the last quotient figure one less; with which find a new subtrahend, (by the rule foregoing) and so on until you can subtract the subtrahend from the dividend.

EXAMPLES.

1. Required the cube root of 18399,744.

$1\dot{8}39\dot{9},74\dot{4}$(26,4 Root. *Ans.*

8

2×2=4×300=1200)10399 first dividend.

7200

6×6=36×2=72×30=2160

6×6×6= 216

9576 1st subtrahend.

26×26=676×300=202800)823744 2d dividend.

811200

4×4=16×26=416×30= 12480

4×4×4= 64

823744 2d subtrahend.

NOTE.—The foregoing example gives a perfect root; and if, when all the periods are exhausted, there happens to be a remainder, you may annex periods of cyphers, and continue the operation, as far as you think it necessary.

	Answers.
2. What is the cube root of 205379?	59
3. Of ——— 614125?	85
4. Of ——— 41421736?	346
5. Of ——— 146363,183?	52,7
6. Of ——— 29,503629?	3,09
7. Of ——— 80,763?	4,32+
8. Of ——— ,162771336?	,546
9. Of ——— ,000684134?	,088+
10. Of ——— 122615327232?	4968

RULE II.

1. Find by trial, a cube near to the given number, and call it the supposed cube.

2. Then, as twice the supposed cube, added to the given number, is to twice the given number added to the supposed cube, so is the root of the supposed cube, to the true root, or an approximation to it.

3. By taking the cube of the root thus found, for the supposed cube, and repeating the operation, the root will be had to a greater degree of exactness.

EXAMPLES.

Let it be required to extract the cube root of 2.

Assume 1,3 as the root of the nearest cube; then—

1,3×1,3×1,3=2,197=supposed cube.

Then, 2,197 2,000 given number.
2 2
——— ———
4,394 4,000
2,000 2,197
——— ———
As 6,394 : 6,197 : : 1,3 : 1,2599 root, which is true to the last place of decimals; but might by repeating the operation, be brought to a greater exactness.

2. What is the cube root of 584,277056?

Ans. 8,36.

3. Required the cube root of 729001101 ?

Ans. 900,0004

QUESTIONS,

Shewing the use of the Cube Root.

1. The statute bushel contains 2150,425 cubic or solid inches. I demand the side of a cubic box, which shall contain that quantity ?

$\sqrt[3]{2150,425}=12,907$ *inch. Ans.*

Note.—The solid contents of similar figures are in proportion to each other, as the cubes of their similar sides or diameters.

2. If a bullet 3 inches diameter, weigh 4lb. what will a bullet of the same metal weigh, whose diameter is 6 inches ?

3×3×3=27 6×6×6=216 As 27 : 4lb. : : 216 : 32lb. *Ans.*

3. If a solid globe of silver, of 3 inches diameter, be worth 150 dollars; what is the value of another globe of silver, whose diameter is six inches ? \$

3×3×3=27 6×6×6=216 As 27 : 150 : : 216 : \$1200. *Ans.*

The side of a cube being given, to find the side of that cube wich shall be double, triple, &c. in quantity to the given cube.

RULE.

Cube your given side, and multiply by the given proportion between the given and required cube, and the cube root of the product will be the side sought.

4. If a cube of silver, whose side is two inches, be worth 20 dollars; I demand the side of a cube of like silver, whose value shall be 8 times as much ?

2×2×2=8 and 8×8=64 $\sqrt[3]{64}=4$ *inches. Ans.*

5. There is a cubical vessel, whose side is 4 feet ; I demand the side of another cubical vessel, which shall contain 4 times as much ?

4×4×4=64 and 64×4=256 $\sqrt[3]{256}=6,349+$*ft. Ans.*

6. A cooper having a cask 40 inches long, and 32 in-

ches at the bung diameter, is ordered to make another cask of the same shape, but to hold just twice as much; what will be the bung diameter and length of the new cask?

$40\times40\times40\times2=128000$ then $\sqrt[3]{128000}=50,3+$ *length.*
$32\times32\times32\times2=65536$ and $\sqrt[3]{65536}=40,3+$ *bung diam.*

A General Rule for Extracting the Roots of all Powers.

RULE.

1. Prepare the given number for extraction, by pointing off from the unit's place, as the required root directs.

2. Find the first figure of the root by trial, and subtract its power from the left hand period of the given number.

3. To the remainder bring down the first figure in the next period, and call it the dividend.

4. Involve the root to the next inferior power to that which is given, and multiply it by the number denoting the given power, for a divisor.

5. Find how many times the divisor may be had in the dividend, and the quotient will be another figure of the root.

6. Involve the whole root to the given power, and subtract it (always) from as many periods of the given number as you have found figures in the root.

7. Bring down the first figure of the next period to the remainder for a new dividend, to which find a new divisor, as before, and in like manner proceed till the whole be finished.

NOTE.—When the number to be subtracted is greater than those periods from which it is to be taken, the last quotient figure must be taken less, &c.

EXAMPLES.

1. Required the cube root of 135796,744 by the above general method.

135796744(51,4 the root.
125=1st subtrahend.

75)107 dividend.

132651=2d subtrahend.
7803) 31457=2d dividend.

135796744=3d subtrahend.

5×5×3=75 first divisor.
51×51×51=132651 second subtrahend.
51×51×3=7803 second divisor.
514×514×514=135796744 third subtrahend.

3. Required the sursolid, or fifth root of 6436343.

6436343(23 root.
32

2×2×2×2×5=80)323 dividend.
23×23×23×23×23=6436343 subtrahend.

NOTE.—The roots of most powers may be found by the square and cube roots only; therefore, when any even power is given, the easiest method will be (especially in a very high power) to extract the square root of it, which reduces it to half the given power, then the square root of that power reduces it to half the same power; and so on, till you come to a square or a cube.

For example: suppose a 12th power be given; the square root of that reduces it to a sixth power: and the square root of a sixth power to a cube.

EXAMPLES.

3. What is the biquadrate, or 4th root of 19987173376? *Ans.* 376.

4. Extract the square, cubed, or 6th root of 12230590464. *Ans.* 48.

5. Extract the square, biquadrate, or 8th root of 7213895789338336. *Ans.* 96.

ALLIGATION,

IS the method of mixing several simples of different qualities, so that the composition may be of a mean or middle quality: It consists of two kinds, viz. Alligation Medial, and Alligation Alternate.

ALLIGATION MEDIAL,

Is when the quantities and prices of several things are given, to find the mean price of the mixture composed of those materials.

RULE.

As the whole composition : is to the whole value : : so is any part of the composition : to its mean price.

EXAMPLES.

1. A farmer mixed 15 bushels of rye, at 64 cents a bushel, 18 bushels of Indian corn, at 55 cts. a bushel, and 21 bushels of oats, at 28 cts. a bushel; I demand what a bushel of this mixture is worth?

bu.		*cts.*	*$cts.*
15	at	64	=9,60
18		55	=9,90
21		28	=5,88
54			25,38

bu. *$ cts.* *bu.*
As 54 : 25,38 : : 1
1
cts.
54)25,38(,47 *Answer.*

2. If 20 bushels of wheat at 1 dol. 35 cts. per bushel, be mixed with 10 bushels of rye at 90 cents per bushel, what will a bushel of this mixture be worth?
Ans. $1, 20*cts.*

3. A Tobacconist mixed 36 lb. of Tobacco, at 1s. 6d. per lb. 12 lb. at 2s. a pound, with 12 lb. at 1s. 10d. per lb.; what is the price of a pound of this mixture?
Ans. 1s. 8*d.*

4. A Grocer mixed 2 C. of sugar, at 56s. per C. and 1 C. at 43s per C. and 2 C. at 50s. per C. together; I demand the price of 3 cwt. of this mixture? *Ans.* £7 13s.

5. A Wine merchant mixes 15 gallons of wine at 4s. 2d. per gallon, with 24 gallons at 6s. 8d. and 20 gallons, at 6s. 3d.; what is a gallon of this composition worth?
Ans. 5s. 10*d.* 2$\frac{43}{59}$*qrs.*

6. A grocer hath several sorts of sugar, viz. one sort at 8 dols. per cwt. another sort at 9 dols. per cwt. a third sort at 10 dols. per cwt. and a fourth sort at 12 dols. per cwt. and he would mix an equal quantity of each together; I demand the price of 3½ cwt. of this mixture?

Ans. $34 12*cts.* 5*m.*

7. A Goldsmith melted together 5 lb. of silver bullion, of 8 oz. fine, 10 lb. of 7 oz. fine, and 15 lb. of 6 oz. fine; pray what is the quality, or fineness of this composition?

Ans. 6*oz.* 13*pwt.* 8*gr. fine.*

8. Suppose 5 lb. of gold of 22 carats fine, 2 lb. of 21 carats fine, and 1 lb. of alloy be melted together; what is the quality, or fineness of this mass?

Ans. 19 *carats fine.*

ALLIGATION ALTERNATE,

IS the method of finding what quantity of each of the ingredients, whose rates are given, will compose a mixture of a given rate; so that it is the reverse of alligation medial, and may be proved by it.

CASE. I.

When the mean rate of the whole mixture, and the rates of all the ingredients are given without any limited quantity.

RULE.

1. Place the several rates, or prices of the simples, being reduced to one denomination, in a column under each other, and the mean price in the like name, at the left hand.

2. Connect, or link, the price of each simple or ingredient, which is less than that of the mean rate, with one or any number of those, which are greater than the mean rate, and each greater rate, or price with one, or any number of the less.

3. Place the difference, between the mean price (or mixture rate) and that of each of the simples, opposite *to the rates* with which they are connected.

4. Then, if only one difference stands against any rate, it will be the quantity belonging to that rate, but if there be several, their sum will be the quantity.

EXAMPLES.

1. A merchant has spices, some at 9d. per lb. some at 1s. some at 2s. and some at 2s. 6d. per lb. how much of each sort must he mix, that he may sell the mixture at 1s. 8d. per pound?

	d.	*d.*	*lb.*	
d. 20	9	10 at	9	*Gives the Answer.* or
	12	4	12	
	24	8	24	
	30	11	30	

	d.	*lb.*	
d. 20	9	4	*Answer.*
	12	10	
	24	11	
	30	8	

2. A grocer would mix the following quantities of sugar; viz. at 10 cents, 13 cents, and 16 cts. per lb.; what quantity of each sort must be taken to make a mixture worth 12 cents per pound?

Ans. 5lb. at 10*cts.* 2*lb. at* 13*cts. and* 2*lb. at* 16 *cts. per lb.*

3. A grocer has two sorts of tea, viz. at 9s. and at 15s. per lb. how must he mix them so as to afford the composition for 12s. per lb.?

Ans. He must mix an equal quantity of each sort.

4. A goldsmith would mix gold of 17 carats fine, with some of 19, 21, and 24 carats fine, so that the compound may be 22 carats fine; what quantity of each must he take.

Ans. 2 *of each of the first three sorts, and* 9 *of the last.*

5. It is required to mix several sorts of rum, viz. at 5s. 7s. and 9s. per gallon, with water at 0 per gallon together, so that the mixture may be worth 6s. per gallon; how much of each sort must the mixture consist of?

Ans. 1 *gal. of Rum at* 5*s.* 1 *do. at* 7*s.* 6 *do at* 9*s. and* 3 *gals. water. Or,* 3 *gals. rum at* 5*s.* 6 *do. at* 7*s.* 1 *do. at* 9*s. and* 1 *gal. water.*

6. A grocer hath several sorts of sugar, viz. one sort at 12 cts. per lb. another at 11 cts. a third at 9 cts. and a fourth at 8 cts. per lb.; I demand how much of each sort must he mix together, that the whole quantity may be afforded at 10 cents per pound?

	lb.	cts.		lb.	cts.		lb.	cts.
1st. Ans.	2 at	12	2d Ans.	1 at	12	3d Ans.	3 at	12
	1 at	11		2 at	11		2 at	11
	1 at	9		2 at	9		2 at	9
	2 at	8		1 at	8		3 at	8

*4th Ans. 3lb. of each sort.**

CASE II.

ALTERNATION PARTIAL.

Or, when one of the ingredients is limited to a certain quantity, thence to find the several quantities of the rest in proportion to the quantity given.

RULE.

Take the difference between each price, and the mean rate, and place them alternately as in Case I. Then, as the difference standing against that simple whose quantity is given, is to that quantity : so is each of the other differences, severally, to the several quantities required.

EXAMPLES.

1. A farmer would mix 10 bushels of wheat, at 70 cts. per bushel, with rye at 48 cts. corn at 36 cts. and barley at 30 cts. per bushel, so that a bushel of the composition may be sold for 38 cents; what quantity of each must be taken.

Mean rate, 38	70	8 stands against the given quantity.
	48	2
	36	10
	30	32

As 8 : 10 : :	2 :	2½ bushels of rye.
	10 :	12½ bushels of corn,
	32 :	40 bushels of barley.

---

* *These four answers arise from as many various ways of linking the rates of the ingredients together.*

Questions in this rule admit of an infinite variety of answers: for after the quantities are found from different methods of linking; any other numbers in the same proportion between themselves, as the numbers which compose the answer, will likewise satisfy the conditions of the question.

2. How much water must be mixed with 100 gallons of rum, worth 7s. 6d. per gallon, to reduce it to 6s. 3d. per gallon? *Ans.* 20 *gallons.*

3. A farmer would mix 20 bushels of rye, at 65 cents per bushel, with barley at 51 cts. and oats at 30 cts. per bushel; how much barley and oats must be mixed with the 20 bushels of rye, that the provender may be worth 41 cents per bushel?

Ans. 20 *bushels of barley, and* $61\frac{9}{11}$ *bushels of oats.*

4. With 95 gallons of rum at 8s. per gallon, I mixed other rum at 6s. 8d. per gallon, and some water; then I found it stood me in 6s. 4d. per gallon; I demand how much rum and how much water I took?

Ans. 95 *gals. rum at* 6s. 8d. *and* 30 *gals. water.*

CASE III.

When the whole composition is limited to a given quantity.

RULE.

Place the difference between the mean rate, and the several prices alternately, as in CASE I.; then, As the sum of the quantities, or difference thus determined, is to the given quantity, or whole composition : so is the difference of each rate, to the required quantity of each rate.

EXAMPLES.

1. A grocer had four sorts of tea, at 1s. 3s. 6s. and 10s. per lb. the worst would not sell, and the best were too dear; he therefore mixed 120 lb. and so much of each sort, as to sell it at 4s. per lb.; how much of each sort did he take?

$$\begin{array}{rr} & \textit{s.} \\ & 1 \\ 4 & 3 \\ & 6 \\ & 10 \end{array}\quad\begin{array}{r} \textit{lb.} \\ 6 \\ 2 \\ 1 \\ 3 \\ \hline 12 \end{array}\quad \begin{array}{c} \textit{lb.}\ \ \textit{lb.} \\ \text{As } 12 : 120 :: \end{array}\left\{\begin{array}{l} \textit{lb.}\qquad\quad \textit{s.} \\ 6 : 60 \text{ at } 1 \\ 2 : 20 — 3 \\ 1 : 10 — 6 \\ 3 : 30 — 10 \\ \hline 120 \end{array}\right\}\text{per lb.}$$

Sum, 12

2. How much water at 0 per gallon, must be mixed with wine at 90 cents per gallon, so as to fill a vessel of 100 gallons, which may be afforded at 60 cents per gallon?

Ans. $33\frac{1}{3}$ *gals. water, and* $66\frac{2}{3}$ *gals. wine.*

3. A grocer having sugars at 8 cts. 16 cts. and 24 cts. per pound, would make a composition of 240 lb. worth 20 cts. per lb. without gain or loss; what quantity of each must be taken?

Ans. 40 *lb. at* 8 *cts.* 40 *at* 16 *cts. and* 160 *at* 24 *cts.*

4. A goldsmith had two sorts of silver bullion, one of 10 oz. and the other of 5 oz. fine, and has a mind to mix a pound of it so that it shall be 8 oz fine; how much of each sort must he take?

Ans. $4\frac{4}{5}$ *of* 5 *oz. fine, and* $7\frac{1}{5}$ *of* 10 *oz. fine.*

5. Brandy at 3s. 6d. and 5s. 9d. per gallon, is to be mixed, so that a hhd. of 63 gallons may be sold for 12*l.* 12s.; how many gallons must be taken of each?

Ans. 14 *gals. at* 5*s.* 9*d. and* 49 *gals. at* 3*s.* 6*d.*

ARITHMETICAL PROGRESSION.

ANY rank of numbers more than two, increasing by common excess, or decreasing by common difference, is said to be in Arithmetical Progression.

So { 2, 4, 6, 8, &c. is an ascending arithmetical series:
   { 8, 6, 4, 2, &c. is a descending arithmetical series:

The numbers which form the series, are called the terms of the progression; the first and last terms of which are called the extremes.*

PROBLEM I.

The first term, the last term, and the number of terms being given, to find the sum of all the terms.

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* *A series in progression includes five parts, viz. the first term, last term, number of terms, common difference, and sum of the series.*

By having any three of these parts given, the other two may be found, which admits of a variety of Problems; but most of them are best understood by an algebraic process, and are here omitted.

RULE.

Multiply the sum of the extremes by the number of terms, and half the product will be the answer.

EXAMPLES.

1. The first term of an arithmetical series is 3, the last term 23, and the number of terms 11; required the sum of the series.

23+3=26 sum of the extremes.

Then 26×11÷2=143 *the Answer.*

2. How many strokes does the hammer of a clock strike, in twelve hours? *Ans.* 78.

3. A merchant sold 100 yards of cloth, viz. the first yard for 1 ct. the second for 2 cts. the third for 3 cts. &c. I demand what the cloth came to at that rate?

Ans. $50½.

4. A man bought 19 yards of linen in arithmetical progression, for the first yard he gave 1s. and for the last yd. 1*l.* 17*s.* what did the whole come to? *Ans.* £18 1*s.*

5. A draper sold 100 yards of broadcloth, at 5 cts. for the first yard, 10 cts. for the second, 15 for the third, &c. increasing 5 cents for every yard; what did the whole amount to, and what did it average per yard?

Ans. Amount $252½, *and the average price is* $2, 52*cts.* 5 *mills per yard.*

6. Suppose 144 oranges were laid 2 yards distant from each other, in a right line, and a basket placed two yards from the first orange, what length of ground will that boy travel over, who gathers them up singly, returning with them one by one to the basket?

Ans. 23 *miles,* 5 *furlongs,* 180 *yds.*

PROBLEM II.

The first term, the last term, and the number of terms given, to find the common difference.

RULE.

Divide the difference of the extremes by the number of terms less 1, and the quotient will be the common difference.

EXAMPLES.

1. The extremes are 3 and 29, and the number of terms 14, what is the common difference?

$$\left.\begin{array}{r}29\\-3\end{array}\right\}\text{ Extremes.}$$

Number of terms less 1=13)26(2 *Ans.*

2. A man had 9 sons, whose several ages differed alike, the youngest was 3 years old, and the oldest 35; what was the common difference of their ages?

Ans. 4 *years.*

3. A man is to travel from New-London to a certain place in 9 days, and to go but 3 miles the first day, increasing every day by an equal excess, so that the last day's journey may be 43 miles: Required the daily increase, and the length of the whole journey?

Ans. The daily increase is 5, *and the whole journey* 207 *miles.*

4. A debt is to be discharged at 16 different payments (in arithmetical progression,) the first payment is to be 14*l.* the last 100*l.*: What is the common difference, and the sum of the whole debt?

Ans. 5*l.* 14*s.* 8*d. common difference, and* 912*l. the whole debt.*

PROBLEM III.

Given the first term, last term, and common difference, to find the number of terms.

RULE.

Divide the difference of the extremes by the common difference, and the quotient increased by 1 is the number of terms.

EXAMPLES.

1. If the extremes be 3 and 45, and the common difference 2; what is the number of terms? *Ans.* 22.

2. A man going a journey, travelled the first day five miles, the last day 45 miles, and each day increased his journey by 4 miles; how many days did he travel, and how far?

Ans. 11 *days, and the whole distance travelled* 275 *miles*

GEOMETRICAL PROGRESSION,

IS when any rank or series of numbers increased by one common multiplier, or decreased by one common divisor; as 1, 2, 4, 8, 16, &c. increase by the multiplier 2; and 27, 9, 3, 1, decrease by the divisor 3.

PROBLEM I.

The first term, the last term (or the extremes) and the ratio given, to find the sum of the series.

RULE.

Multiply the last term by the ratio, and from the product subtract the first term; then divide the remainder by the ratio, less by 1, and the quotient will be the sum of all the terms.

EXAMPLES.

1. If the series be 2, 6, 18, 54, 162, 486, 1458, and the ratio 3, what is its sum total?

$$\frac{3\times1458-2}{3-1}=2186 \text{ the Answer.}$$

2. The extremes of a geometrical series are 1 and 65536, and the ratio 4; what is the sum of the series?

Ans. 87381.

PROBLEM II.

Given the first term, and the ratio, to find any other term assigned.*

CASE I.

When the first term of the series and the ratio are equal.†

---

*As the last term in a long series of numbers is very tedious to be found by continual multiplications, it will be necessary for the readier finding it out, to have a series of numbers in arithmetical proportion, called indices, whose common difference is 1.

† When the first term of the series and the ratio are equal, the indices must begin with the unit, and in this case, the

1. Write down a few of the leading terms of the series, and place their indices over them, beginning the indices with an unit or 1.

2. Add together such indices, whose sum shall make up the entire index to the sum required.

3. Multiply the terms of the geometrical series belonging to those indices together, and the product will be the term sought.

EXAMPLES.

1. If the first be 2, and the ratio 2; what is the 13th term.

1, 2, 3, 4, 5, indices, Then 5+5+3=13
2, 4, 8, 16, 32, leading terms. 32×32×8=8192 *Ans.*

2. A draper sold 20 yards of superfine cloth, the first yard for 3d. the second for 9d. the third for 27d. &c. in triple proportion geometrical; what did the cloth come to at that rate?

The 20th, or last term is 3486784401*d.*

Then $\dfrac{3+3486784401-3}{3-1}=5230176600d.$ the sum of all the terms (by Prob. I.) equal to £21792402 10*s.* *Ans.*

3. A rich miser thought 20 guineas a price too much for 12 fine horses, but agreed to give 4 cents for the first, 16 cents for the second, and 64 cents for the third horse, and so on in quadruple or fourfold proportion to the last: what did they come to at that rate, and how much did they cost per head, one with another?

Ans. The 12 *horses came to* $223696, 20*cts. and the average price was* $18641, 35*cts. per head.*

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product of any two terms is equal to that term, signified by the sum of their indices.

Thus, $\begin{cases}1\ \ 2\ \ 3\ \ 4\ \ 5\ \text{\&c. Indices or arithmetical series.}\\ 2\ \ 4\ \ 8\ \ 16\ \ 32\ \text{\&c. geometrical series.}\end{cases}$

Now, 3+2 = 5 = *the index of the fifth term, and*
4×8 = 32 = *the fifth term.*

CASE II.

When the first term of the series and the ratio are different, that is, when the first term is either greater or less than the ratio.*

1. Write down a few of the leading terms of the series, and begin the indices with a cypher: Thus, 0, 1, 2, 3, &c.

2. Add together the most convenient indices to make an index less by 1 than the number expressing the place of the term sought.

3. Multiply the terms of the geometrical series together belonging to those indices, and make the product a dividend.

4. Raise the first term to a power whose index is one less than the number of the terms multiplied, and make the result a divisor.

5. Divide, and the quotient is the term sought.

EXAMPLES.

4. If the first of a geometrical series be 4, and the ratio 3, what is the 7th term?

0, 1, 2, 3, Indices.
4, 12, 36, 108, leading terms.
3+2+1=6, the index of the 7th term.

$$\frac{108\times36\times12=46656}{16}=2916 \text{ the 7th term required.}$$

Here the number of terms multiplied are three; therefore the first term raised to a power less than three, is the 2d power or square of 4=16 the divisor.

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* *When the first term of the series and the ratio are different, the indices must begin with a cypher, and the sum of the indices made choice of must be one less than the number of terms given in the question: because 1 in the indices stands over the second term, and 2 in the indices over the third term, &c. and in this case, the product of any two terms, divided by the first, is equal to that term beyond the first, signified by the sum of their indices.*

Thus, $\begin{cases} 0,\ 1,\ 2,\ 3,\ 4, \ \&c. \textit{ Indices.} \\ 1,\ 3,\ 9,\ 27,\ 81, \ \&c. \textit{ Geometrical series.} \end{cases}$

Here 4+3=7 *the index of the* 8th *term.*

81×27=2187 *the* 8th *term, or the* 7th *beyond the* 1st.

5. A Goldsmith sold 1 lb. of gold, at 2 cents for the first ounce, 8 cents for the second, 32 cents for the third, &c. in a quadruple proportion geometrically; what did the whole come to? *Ans.* $111848, 10*cts.*

6. What debt can be discharged in a year, by paying 1 farthing the first month, 10 farthings, (or 2½d.) the second, and so on, each month in a tenfold proportion? *Ans.* £115740740 14*s.* 9*d.* 3*qrs.*

7. A thresher worked 20 days for a farmer, and received for the first day's work four barley-corns, for the second 12 barley-corns, for the third 36 barley-corns, and so on in triple proportion geometrical. I demand what the 20 days' labor came to, supposing a pint of barley to contain 7680 corns, and the whole quantity to be sold at 2s. 6d. per bushel? *Ans.* £1773 7*s.* 6*d.* *rejecting remainders.*

8. A man bought a horse, and by agreement was to give a farthing for the first nail, two for the second, four for the third, &c. There were four shoes, and eight nails in each shoe; what did the horse come to at that rate? *Ans.* £4473924 5*s.* 3¾*d.*

9. Suppose a certain body, put in motion, should move the length of one barley-corn the first second of time, one inch the second, and three inches the third second of time, and so continue to increase its motion in triple proportion geometrical; how many yards would the said body move in the term of half a minute?

Ans. 953199685623 *yds.* 1*ft.* 1*in.* 1*b.c.* *which is no less than five hundred and forty-one millions of miles.*

POSITION.

POSITION is a rule which, by false or supposed numbers, taken at pleasure, discovers the true ones required. It is divided into two parts, Single or Double.

SINGLE POSITION,

Is when one number is required, the properties of which are given in the question.

RULE.

1. Take any number and perform the same operation with it, as is described to be performed in the question.

2. Then say; as the result of the operation : is to the given sum in the question : : so is the supposed number : to the true one required.

The method of proof is by substituting the answer in the question.

EXAMPLES.

1. A schoolmaster being asked how many scholars he had, said, If I had as many more as I now have, half as many, one-third and one-fourth as many, I should then have 148; How many scholars had he?

Suppose he had	12	As 37 : 148 : : 12 :	48 *Ans.*
as many =	12		48
½ as many =	6		24
⅓ as many =	4		16
¼ as many =	3		12
Result,	37	*Proof,*	148

2. What number is that which being increased by ½, ⅓, and ¼ of itself, the sum will be 125? *Ans.* 60.

3. Divide 93 dollars between A, B and C, so that B's share may be half as much as A's, and C's share three times as much as B's.

Ans. A's share $31, *B's* $15½, *and C's* $46½.

4. A, B and C, joined their stock and gained 360 dols. of which A took up a certain sum, B took 3½ times as much as A, and C took up as much as A and B both; what share of the gain had each?

Ans. A $40, *B* $140, *and C* $180.

5. Delivered to a banker a certain sum of money, to receive interest for the same at 6*l.* per cent. per annum, simple interest, and at the end of twelve years received 731*l.* principal and interest together; what was the sum delivered him at first? *Ans.* £425.

6. A vessel has 3 cocks, A, B and C; A can fill it in 1 hour, B in 2 hours and C in 4 hours; in what time will they all fill it together? *Ans.* 34min. 17⅐sec.

DOUBLE POSITION,

TEACHES to resolve questions by making two suppositions of false numbers.*

RULE.

1. Take any two convenient numbers, and proceed with each according to the conditions of the question.

2. Find how much the results are different from the results in the question.

3. Multiply the first position by the last error, and the last position by the first error.

4. If the errors are alike, divide the difference of the products by the difference of the errors, and the quotient will be the answer.

5. If the errors are unlike, divide the sum of the products by the sum of the errors, and the quotient will be the answer.

NOTE.—The errors are said to be alike when they are both too great, or both too small; and unlike, when one is too great, and the other too small.

EXAMPLES.

1. A purse of 100 dollars is to be divided among 4 men, A, B, C and D, so that B may have 4 dollars more than A, and C 8 dollars more than B, and D twice as many as C; what is each one's share of the money?

1st. Suppose	A	6	2d. Suppose	A	8
	B	10		B	12
	C	18		C	20
	D	36		D	40
		70			80
		100			100
1st. error		30	2d. error		20

Those questions, in which the results are not proportional to their positions, belong to this rule; such as those in which the number sought is increased or diminished by some given number, which is no known part of the number required.

The errors being alike, are both too small, therefore,

Pos. *Err.*
6 30
X
8 20
— —
240 120
120
—
10)120(12 A's part.

	$
A	12
B	16
C	24
D	48
Proof	100

2. A, B, and C, built a house which cost 500 dollars, of which A paid a certain sum; B paid 10 dollars more than A, and C paid as much as A and B both; how much did each man pay?

Ans. A paid $120, *B* $130, *and C* $250.

3. A man bequeathed 100*l.* to three of his friends, after this manner: the first must have a certain portion, the second must have twice as much as the first, wanting 8*l.* and the third must have three times as much as the first, wanting 15*l.*; I demand how much each man must have?

Ans. The first £20 10s. *second* £33, *third* £46 10s.

4. A laborer was hired 60 days upon this condition; that for every day he wrought he should receive 4s. and for every day he was idle should forfeit 2s.; at the expiration of the time he received 7*l.* 10s.; how many days did he work, and how many was he idle?

Ans. He wrought 45 *days, and was idle* 15 *days.*

5. What number is that which being increased by its ½, its ¼, and 18 more, will be doubled? *Ans.* 72.

6. A man gave to his three sons all his estate in money, viz. to F half, wanting 50*l.* to G one-third, and to H the rest, which was 10*l.* less than the share of G; I demand the sum given, and each man's part?

Ans. the sum given was £360, *whereof F had* £130, *G* £120, *and H* £110.

7. Two men, A and B, lay out equal sums of money in trade; A gains 126*l.* and B looses 87*l.* and A's money is now double to B's; what did each lay out?

Ans. £300.

8. A farmer having driven his cattle to market, received for them all 130*l.* being paid for every ox 7*l.* for every cow 5*l.* and for every calf 1*l.* 10s. there were twice as many cows as oxen, and three times as many calves as cows; how many were there of each sort?

Ans. 5 *oxen,* 10 *cows, and* 30 *calves.*

9. A, B and C, playing at cards, staked 324 crowns; but disputing about tricks, each man took as many as he could: A got a certain number; B as many as A and 15 more; C got a 5th part of both their sums added together; how many did each get?

Ans. A got 127½, *B* 142½, *C* 54.

PERMUTATION OF QUANTITIES,

Is the shewing how many different ways any given number of things may be changed.

To find the number of Permutations or changes, that can be made of any given number of things, all different from each other.

RULE.

Multiply all the terms of the natural series of numbers, from one up to the given number, continually together, and the last product will be the answer required.

EXAMPLES.

1. How many changes can be made of the three first letters of the alphabet?

Proof,	1	a b c
	2	a c b
	3	b a c
	4	b c a
	5	c b a
	6	c a b

$1 \times 2 \times 3 = 6$ *Ans.*

2. How many changes may be rung on 9 bells?

Ans. 362880.

8. Seven gentlemen met at an inn, and were so well pleased with their host, and with each other, that they agreed to tarry so long as they, together with their host, could sit every day in a different position at dinner; how long must they have staid at said inn to have fulfilled their agreement? *Ans.* $110\frac{170}{365}$ *years.*

ANNUITIES OR PENSIONS,

COMPUTED AT

COMPOUND INTEREST.

CASE I.

To find the amount of an annuity, or Pension, in arrears, at Compound Interest.

RULE.

1. Make 1 the first term of a geometrical progression, and the amount of $1 or £1 for one year, at the given rate per cent. the ratio.

2. Carry on the series up to as many terms as the given number of years, and find its sum.

3. Multiply the sum thus found, by the given annuity, and the product will be the amount sought.

EXAMPLES.

1. If 125 dols. yearly rent, or annuity, be forborne, (or unpaid) 4 years; what will it amount to, at 6 per cent. per annum, compound interest?

1+1,06+1,1236+1,191016=4,374616 sum of the series.*—Then, 4,374616×125=$546,827 the amount sought.

OR BY TABLE II.

Multiply the Tabular number under the rate and opposite to the time, by the annuity, and the product will be the amount sought.

**The sum of the series thus found, is the amount of 1l. or 1 dollar annuity, for the given time, which may be found in Table II. ready calculated.*

Hence, either the amount or present worth of annuities may be readily found by Tables for that purpose.

2. If a salary of 60 dollars per annum to be paid yearly, be forborne 20 years, at 6 per cent. compound interest; what is the amount?

Under 6 per cent. and opposite 20, in Table II, you will find,

Tabular number=36,78559
60 Annuity.

Ans. \$2207,13540=\$2207, 13*cts.* 5*m.*+

3. Suppose an Annuity of 100*l.* be 12 years in arrears, it is required to find what is now due, compound interest being allowed at 5*l.* per cent. per annum?

Ans. £1591 14*s.* 3,024*d.* (by Table II.)

4. What will a pension of 120*l.* per annum, payable yearly, amount to in 3 years, at 5*l.* per cent. compound interest? *Ans.* £378 6*s.*

II. To find the present worth of Annuities at Compound Interest.

RULE.

Divide the annuity, &c. by that power of the ratio signified by the number of years, and subtract the quotient from the annuity: This remainder being divided by the ratio less 1, the quotient will be the present value of the Annuity sought.

EXAMPLES.

1. What ready money will purchase an Annuity of 50*l.* to continue 4 years, at 5*l.* per cent. compound interest?

4th power of the ratio, } =1,215506)50,00000(41,13513+
From 50
Subtract 41,13513

Divis. 1,05—1=05)8,86487
177,297=£177 5s. 11¼d. *Ans.*

BY TABLE III.

Under 5 per cent. and even with 4 years.

We have 3,54595=present worth of 1*l.* for 4 years.
Multiply by 50=Annuity.

Ans. £177,29750=present worth of the annuity.

2. What is the present worth of an annuity of 60 dols. per annum, to continue 20 years, at 6 per cent. compound interest? *Ans.* $688, 19½*cts.*+

3. What is 30*l.* per annum, to continue 7 years, worth in ready money, at 6 per cent. compound interest? *Ans.* £167 9*s.* 5*d.*+

III. To find the present worth of Annuities, Leases, &c. taken in REVERSION, at Compound Interest.

1. Divide the Annuity by that power of the ratio denoted by the time of its continuance.

2. Subtract the quotient from the Annuity: Divide the remainder by the ratio less 1, and the quotient will be the present worth to commence immediately.

3. Divide this quotient by that power of the ratio denoted by the time of Reversion, (or the time to come before the Annuity commences) and the quotient will be the present worth of the Annuity in Reversion.

EXAMPLES.

1. What ready money will purchase an Annuity of 50*l.* payable yearly, for 4 years: but not to commence till two years, at 5 per cent.?

4th power of 1,05=1,215506)50,00000(41,13513
Subtract the quotient=41,13513

Divide by 1,05—1=,05)8,86487
2d. power of 1,05=1,1025)177,297(160,8136=£160 16*s.* 3*d.* 1*qr.* present worth of the Annuity in Reversion.

OR BY TABLE III.

Find the present value of 1*l.* at the given rate for the sum of the time of continuance, and time in reversion added together; from which value subtract the present worth of 1*l.* for the time in reversion, and multiply the remainder by the Annuity; the product will be the answer.

Thus in Example 1.
Time of continuance, 4 years.
Ditto of reversion, 2

The sum, =6 years, gives 5,075692
Time in reversion. =2 years, —— 1,859410

Remainder, 3,216282 ×50
Ans. £160,8141

2. What is the present worth of 75*l.* yearly rent, which is not to commence until 10 years hence, and then to continue 7 years after that time at 6 per cent.?
Ans. £233 15*s.* 9*d.*

3. What is the present worth of the reversion of a lease of 60 dollars per annum, to continue 20 years, but not to commence till the end of 8 years, allowing 6 per cent. to the purchaser? *Ans.* $451 78*cts.* 2$\frac{2}{10}$*m.*

IV. To find the present worth of a Freehold Estate, or an Annuity to continue forever, at Compound Interest.

RULE.

As the rate per cent. is to 100*l.* : so is the yearly rent to the value required.

EXAMPLES.

1. What is the worth of a Freehold Estate of 40*l.* per annum, allowing 5 per cent. to the purchaser?
As £5 : £100 : : £40 : £800 *Ans.*

2. An estate brings in yearly 150*l.* what would it sell for, allowing the purchaser 6 per cent. for his money?
Ans. £2500

V. To find the present worth of a Freehold Estate, in Reversion, at Compound Interest.

RULE.

1. Find the present value of the estate (by the foregoing rule) as though it were to be entered on immediately, and divide the said value by that power of the ratio denoted by the time of reversion, and the quotient will be the present worth of the estate in Reversion.

EXAMPLES.

1. Suppose a freehold estate of 40*l.* per annum to commence two years hence, be put on sale; what is its value, allowing the purchaser 5*l.* per cent.?

As 5 : 100 : : 40 : 800=present worth if entered on immediately.

Then, $1,05^2$=1,1025)800,00(725,62358=725*l.* 12*s.* 5½*d.*=present worth of £800 in two years reversion. *Ans.*

OR BY TABLE III.

Find the present worth of the annuity, or rent, for the time of reversion, which subtract from the value of the immediate possession, and you will have the value of the estate in reversion.

Thus in the foregoing example,
1,859410=present worth of 1*l.* for 2 years.
40=annuity or rent.

74,376400=present worth of the annuity or rent, for [the time of reversion.

From 800,0000=value of immediate possession.
Take 74,3764=present worth of rent.

*£*725,6236=*£*725 12*s.* 5½*d.* *Ans.*

2. Suppose an estate of 90 dollars per annum, to commence 10 years hence, were to be sold, allowing the purchaser 6 per cent.; what is it worth?

Ans. $837, 39*cts.* 2*m.*

3. Which is the most advantageous, a term of 15 years, in an estate of 100*l.* per annum; or the reversion of such an estate forever after the said 15 years, computing at the rate of 5 per cent. per annum, compound interest?

Ans. The first term of 15 years is better than the reversion forever afterwards, by £75 18*s.* 7½*d.*

* * *

A COLLECTION OF QUESTIONS TO EXERCISE THE FOREGOING RULES.

1. I demand the sum of 1748½ added to itself?

Ans. 3497.

2. What is the difference between 41 eagles, and 4099 dimes? *Ans.* 10*cts.*

3. What number is that which being multiplied by 21, the product will be 1365? *Ans.* 65.

4. What number is that which being divided by 19, the quotient will be 72? *Ans.* 1368.

5. What number is that which being multiplied by 15, the product will be $\frac{3}{4}$? *Ans.* $\frac{1}{20}$.

6. There are 7 chests of drawers, in each of which there are 18 drawers, and in each of these there are six divisions, in each of which is 16*l.* 6s. 8d.; how much money is there in the whole? *Ans.* £12348.

7. Bought 36 pipes of wine for 4536 dollars; how must I sell it a pipe to save one for my own use, and sell the rest for what the whole cost? *Ans.* $129, 60*cts.*

8. Just 16 yards of German serge,
For 90 dimes had I;
How many yards of that same cloth
Will 14 eagles buy? *Ans.* 248*yds.* 3*qrs.* 2$\frac{2}{9}$*na.*

9. A certain quantity of pasture will last 963 sheep 7 weeks, how many must be turned out that it will last the remainder 9 weeks? *Ans.* 214.

10. A grocer bought an equal quantity of sugar, tea, and coffee, for 740 dollars; he gave 10 cents per lb. for the sugar, 60 cts. per lb. for the tea, and 20 cts. per lb. for the coffee; required the quantity of each?

Ans. 822*lb.* 3*oz.* 8$\frac{8}{9}$*dr.*

11. Bought cloth at 1\frac{1}{4}$ a yard, and lost 25 per cent. how was it sold a yard? *Ans.* 93$\frac{3}{4}$*cts.*

12. The third part of an army was killed, the fourth part taken prisoners, and 1000 fled; how many were in this army, how many killed, and how many captives?

Ans. 2400 *in the army*, 800 *killed, and* 600 *taken prisoners.*

13. Thomas sold 150 pine apples at 33$\frac{1}{3}$ cents a piece, and received as much money as Harry received for a certain number of water-mellons, which he sold at 25 cents a piece; how much money did each receive, and how many mellons had Harry?

Ans. Each received $50, *and Harry sold* 200 *mellons.*

14. Said John to Dick, my purse and money are worth 9*l.* 2s. but the money is twenty-five times as much as the purse; I demand how much money was in it? *Ans.* £8 15*s.*

15. A young man received 210*l.* which was $\frac{2}{3}$ of his elder brother's portion; now, three times the elder brother's portion was half the father's estate; what was the value of the estate? *Ans.* £1890.

16. A hare starts 40 yards before a grey-hound, and is not perceived by him till she has been up 40 seconds; she scuds away at the rate of ten miles an hour, and the dog, on view, makes after her at the rate of 18 miles an hour: How long will the course hold, and what space will be ran over, from the spot where the dog started?

Ans. $60\frac{5}{22}$ *sec. and* 530*yds. space.*

17. what number multiplied by 57 will produce just what 134 multiplied by 71 will do? *Ans.* $166\frac{52}{57}$.

18. There are two numbers, whose product is 1610, the greater is given 46; I demand the sum of their squares, and the cube of their difference?

Ans. the sum of their squares is 3341. *The cube of their difference is* 1331.

19. Suppose there is a mast erected, so that $\frac{1}{9}$ of its length stands in the ground, 12 feet of it in the water, and $\frac{5}{6}$ of its length in the air, or above water; I demand the whole length? *Ans.* 216 *feet.*

20. What difference is there between the interest of 500*l.* at 5 per cent. for 12 years, and the discount of the same sum, at the same rate, and for the same time?

Ans. £112 10*s.*

21. A stationer sold quills at 11s. per thousand, by which he cleared $\frac{3}{8}$ of the money, but growing scarce raised them to 13s. 6d. per thousand; what might he clear per cent. by the latter price?

Ans. £96 7*s.* $3\frac{8}{11}$*d.*

22. Three persons purchase a West-India sloop, towards the payment of which A advanced $\frac{3}{8}$, B $\frac{3}{7}$, and C 140*l.* How much paid A and B, and what part of the vessel had C?

Ans. A paid £$267\frac{3}{11}$, *B* £$305\frac{5}{11}$, *and C's part of the vessel was* $\frac{11}{56}$.

23. What is the purchase of 1200*l.* bank stock, at $103\frac{5}{8}$ per cent.? *Ans.* £1243 10*s.*

24. Bought 27 pieces of Nankeens, each $11\frac{1}{2}$ yards, at

14s. 4½d. a piece, which were sold at 18d. a yard; required the prime cost, what it sold for, and the gain.

£. s. d.
Ans. *Prime cost,* 19 8 1½
Sold for, 23 5 9
Gain 3 17 7½

25. Three partners, A, B and C, join their stock, and buy goods to the amount of £1025,5; of which A put in a certain sum; B put in....I know not how much, and C the rest; they gained at the rate of 24*l.* per cent.: A's part of the gain is ½, B's ⅕, and C's the rest. Required each man's particular stock.

£.
Ans. *A's stock was* 512,75
B's —— —— 205,1
C's —— —— 307,65

26. What is that number which being divided by ¾, the quotient will be 21? *Ans.* 15¾.

27. If to my age there added be,
One-half, one-third, and three times three,
Six score and ten the sum will be;
What is my age, pray shew it me?

Ans. 66.

28. A gentleman divided his fortune among his three sons, giving A 9*l.* as often as B 5*l.* and to C but 3*l.* as often as B 7*l.* and yet C's dividend was 2584*l.*; what did the whole estate amount to?

Ans. £19466 2*s.* 8*d.*

29. A gentleman left his son a fortune, ¼ of which he spent in three months; 3/7 of the remainder lasted him 10 months longer, when he had only 2524 dollars left; pray what did his father bequeath him?

Ans. $5889, 33*cts.*+

30. In an orchard of fruit trees, ½ of them bear apples, ¼ pears, ⅙ plums, 40 of them peaches, and 10 cherries; how many trees does the orchard contain? *Ans.* 600.

31. There is a certain number, which being divided by 7, the quotient resulting multiplied by 3, that product divided by 5, from the quotient 20 being subtracted, and 80 added to the remainder, the half sum shall make 65; can you tell me the number? *Ans.* 1400.

32 What part of 25 is $\frac{5}{8}$ of an unit ?

Ans. $\frac{1}{40}$.

33. If A can do a piece of work alone in 10 days, B in 20 days, C in 40 days, and D in 80 days; set all four about it together, in what time will they finish it ?

Ans. $5\frac{1}{3}$ *days.*

34. A farmer being asked how many sheep he had, answered, that he had them in five fields, in the first he had $\frac{1}{4}$ of his flock, in the second $\frac{1}{6}$, in the third $\frac{1}{8}$, in the fourth $\frac{1}{12}$, and in the fifth 450; how many had he ?

Ans. 1200.

35. A and B together can build a boat in 18 days, and with the assistance of C they can do it in 11 days; in what time would C do it alone ? *Ans.* $28\frac{2}{7}$ *days.*

36. There are three numbers, 23, 25, and 42; what is the difference between the sum of the squares of the first and last, and the cube of the middlemost ?

Ans. 13332.

37. Part 1200 acres of land among A, B, and C, so that B may have 100 more than A, and C 64 more than B. *Ans.* *A* 312, *B* 412, *C* 476.

38. If 3 dozen pair of gloves be equal in value to 2 pieces of holland, 3 pieces of Holland to 7 yards of satin, 6 yards of satin to 2 pieces of Flanders lace, and 3 pieces of Flanders lace to 81 shillings; how many dozen pair of gloves may be bought for 28s. ?

Ans. 2 *dozen pair.*

39. A lets B have a hogshead of sugar of 18 cwt. worth 25 dollars, for 7 dollars the cwt. $\frac{1}{3}$ of which he is to pay in cash. B hath paper worth 2 dollars per ream, which he gives A for the rest of his sugar, at $2\frac{1}{2}$ dollars per ream; which gained most by the bargain ?

Ans. *A by* \$19, 20*cts.*

40. A father left his two sons (the one 11 and the other 16 years old) 10000 dollars, to be divided so that each share, being put to interest at 5 per cent. might amount to equal sums when they would be respectively 21 years of age. Required the shares ?

Ans. $5454\frac{6}{11}$ and $4545\frac{5}{11}$ *dollars.*

41. *Bought a certain quantity of broadcloth for 38l.*

5s. and if the number of shillings which it cost per yard were added to the number of yards bought, the sum would be 386; I demand the number of yards bought, and at what price per yard?

Ans. 365 *yds. at* 21*s. per yard.*
Solved by PROBLEM VI. page 183.

42. Two partners, Peter and John, bought goods to the amount of 1000 dollars; in the purchase of which, Peter paid more than John, and John paid....I know not how much: They then sold their goods for ready money, and thereby gained at the rate of 200 per cent. on the prime cost: they divided the gain between them in proportion to the purchase money that each paid in buying the goods; and Peter says to John, My part of the gain is really a handsome sum of money; I wish I had as many such sums as your part contains dollars, I should then have $960000. I demand each man's particular stock in purchasing the goods.

Ans. Peter paid 600 *dollars, and John paid* 400.

THE FOLLOWING QUESTIONS ARE PROPOSED TO SURVEYORS.

1. Required to lay out a lot of land in form of a long square, containing 3 acres, 2 roods, and 29 rods, that shall take just 100 rods of wall to enclose, or fence it round; pray how many rods in length, and how many wide, must said lot be?

Ans. 31 *rods in length, and* 19 *in breadth.*
Solved by PROBLEM VI. page 183.

2. A tract of land is to be laid out in form of an equal square, and to be enclosed with a post and rail fence 5 rails high; so that each rod of fence shall contain 10 rails. How large must this noble square be to contain just as many acres as there are rails in the fence that encloses it, so that every rail shall fence an acre?

Ans. the tract of land is 20 *miles square, and contains* 256000 *acres.*

Thus, 1 mile$=$320 rods: then $320\times320\div160=640$ *acres*: and $320\times4\times10=12800$ rails. As 640 : 12800 : : *12800 :* 256000 rails, which will enclose 256000 acres= *20 miles* square.

AN

APPENDIX,

CONTAINING

SHORT RULES,

FOR CASTING INTEREST AND REBATE;

TOGETHER WITH SOME

USEFUL RULES,

FOR FINDING THE CONTENTS OF SUPERFICIES, SOLIDS, &c.

SHORT RULES FOR CASTING INTEREST AT SIX PER CENT.

I. To find the interest of any sum of shillings for any number of days less than a month, at 6 per cent.

RULE.

1. Multiply the shillings of the principal by the number of days, and that product by 2, and cut off three figures to the right hand, and all above three figures will be the interest in pence.

2. Multiply the figures cut off by 4, still striking off three figures to the right hand, and you will have the farthings, very nearly.

EXAMPLES.

1. Required the interest of 5*l.* 8s. for 25 days.

£. s.
5,8=108×25×2=5,400, and 400×4=1,600

Ans. 5*d.* 1,6*qrs.*

2. What is the interest of 21*l.* 3s. for 29 days?

Ans. 2s. 0d. 2qrs.

FEDERAL MONEY.

II. To find the interest of any number of cents for any number of days less than a month, at 6 per cent.

RULE.

Multiply the cents by the number of days, divide the product by 6, and point off two figures to the right, and all the figures at the left hand of the dash, will be the interest in mills, nearly.

EXAMPLES.

Required the interest of 85 dollars, for 20 days.

$ *cts.* *mills.*

85=8500×20÷6=283,33 *Ans.* 283 which is 28 *cts.* 3 *mills.*

2. What is the interest of 73 dollars 41 cents, or 7341 cents, for 27 days, at 6 per cent.?

Ans. 330 *mills, or* 33 *cts.*

* * *

III. When the principal is given in pounds, shillings, &c. New-England currency, to find the interest for any number of days, less than a month, in Federal Money.

RULE.

Multiply the shillings in the principal by the number of days, and divide the product by 36, the quotient will be the interest in mills, for the given time, nearly, omitting fractions.

EXAMPLE.

Required the interest, in Federal Money, of 27*l.* 15*s.* for 27 days, at 6 per cent.

£. *s.* *s.*

Ans. 27 15=555×27÷36=416 *mills.*=41*cts.* 6*m.*

* * *

IV. When the principal is given in Federal Money, and you want the interest in shillings, pence, &c. New-England currency, for any number of days less than a month.

RULE.

Multiply the principal, in cents, by the number of days, and point off five figures to the right hand of the product, which will give the interest for the given time, in shillings and decimals of a shilling, very nearly.

EXAMPLES.

A note for 65 dollars, 31 cents, has been on interest 25 days; how much is the interest thereof, in New-England currency?

$ *cts.* *s.* *s.* *d.* *qrs.*
Ans. 65,31=6531×25=1,63275=1 7 2

Remarks.—In the above, and likewise in the preceding practical Rules, (page 127) the interest is confined at six per cent. which admits of a variety of short methods of casting; and when the rate of interest is 7 per cent. as established in New-York, &c. you may first cast the interest at 6 per cent. and add thereto one sixth of itself, and the sum will be the interest at 7 per cent. which perhaps, many times, will be found more convenient than the general rule of casting interest.

EXAMPLE.

Required the interest of 75*l.* for 5 months at 7 per cent.

s.
7,5 for 1 month.
5
——— £. *s.* *d.*
37,5=1 17 6 for 5 months at 6 per cent.
+$\frac{1}{6}$= 6 3
———
Ans. £2 3 9 for ditto at 7 per cent.

* * *

A SHORT METHOD FOR FINDING THE REBATE OF ANY GIVEN SUM, FOR MONTHS AND DAYS.

RULE.

Diminish the interest of the given sum for the time by its own interest, and this gives the Rebate very nearly.

EXAMPLES.

1. What is the rebate of 50 dollars for six months, at 6 per cent.?

	$	cts.
The interest of 50 dollars for 6 months, is	1	50
And, the interest of 1 dol. 50 cts. for 6 months, is		,4
Ans. Rebate,	$1	46

2. What is the rebate of 150*l.* for 7 months, at 5 per cent.?

	£.	s.	d.
Interest of 150*l.* for 7 months, is	4	7	6
Interest of 4*l.* 7s. 6d. for 7 months, is		2	6½
Ans.	£4	4	11½ nearly.

By the above Rule, those who use interest tables in their counting-houses, have only to deduct the interest of the interest, and the remainder is the discount.

* * *

A concise Rule to reduce the currencies of the different States, where a dollar is an even number of shillings, to Federal Money.

RULE I.

Bring the given sum into a decimal expression by inspection, (as in Problem I. page 87) then divide the whole by ,3 in New-England and by ,4 in New-York currency, and the quotient will be dollars, cents, &c.

EXAMPLES.

1. Reduce 54*l.* 8s. 3½d. New-England currency, to Federal Money.

,3)54,415 decimally expressed.

Ans. $181,38 *cts.*

2. Reduce 7s. 11¾d. New-England currency, to Federal Money.

7s. 11¾*d.*=£0,399 then, ,3),399

Ans. $1,33

3. Reduce 513*l.* 16s. 10d. New-York, &c. currency, to Federal Money.

,4)513,842 decimal

Ans. $1284,60½

4. Reduce 19s. 5¾d. New-York, &c. currency, to Federal money.

,4)0,974 decimal of 19s. 5¾d.

$2,43½ *Ans.*

5. Reduce 64*l.* New-England currency, to Federal Money.

,3)64000 dec. [illegible] expression.

$213,33⅓ *Ans.*

Note.—By the foregoing rule you may carry on the decimal to any degree of exactness; but in ordinary practice, the following *Contraction* may be useful.

RULE II.

To the shillings contained in the given sum, annex 8 times the given pence, increasing the product by 2; then divide the whole by the number of shillings contained in a dollar, and the quotient will be cents.

EXAMPLES.

1. Reduce 45s. 6d. New-England currency, to Federal Money.

6×8+2 = 50 to be annexed.

6)45,50 or 6)4550

$ *cts.*

$7,58⅚ *Ans.* 758 *cents.* =7,58.

2. Reduce 2*l.* 10s. 9d. New-York, &c. currency, to Federal Money.

9×8+2 = 74 to be annexed.

Then 8)5074 Or thus, 8)50,74

$ *cts.*

Ans. 634 *cents.*=6 34 $6,34 *Ans.*

N. B. When there are no pence in the given sum, you must annex two cyphers to the shillings; then divide as before, &c.

3. Reduce 3*l.* 5s. New-England currency, to Federal Money.

3*l.* 5s.=65s. Then 6)6500

Ans. 1083 cents.

SOME USEFUL RULES,

FOR FINDING THE CONTENTS OF SUPERFICIES AND SOLIDS.

SECTION I. OF SUPERFICIES.

The superficies or area of any plane surface, is composed or mad[illegible]f squares, either greater or less, according to the di[illegible] measures by which the dimensions of the figure a[illegible]n or measured:—and because 12 inches in length make 1 foot of long measure, therefore, 12×12=144, the square inches in a superficial foot, &c.

ART. I. To find the area of a square having equal sides.

RULE.

Multiply the side of the square into itself, and the product will be the area, or content.

EXAMPLES.

1. How many square feet of boards are contained in the floor of a room which is 20 feet square?

20×20=400 feet, *the Answer.*

2. Suppose a square lot of land measures 26 rods on each side, how many acres doth it contain?

NOTE.—160 square rods make an acre.

Therefore, 26×26=676 sq. rods, and 676÷160=4a. 36r. *the Answer.*

ART. 2. To measure a parallelogram, or long square.

RULE.

Multiply the length by the breadth, and the product will be the area, or superficial content.

EXAMPLES.

1. A certain garden, in form of a long square, is 96 ft. long, and 54 wide; how many square feet of ground are contained in it? *Ans.* 96×54=5144 *square feet.*

2. A lot of land, in form of a long square, is 120 rods in length, and 60 rods wide; how many acres are in it?

120×60=7200 *sqr. rods, then* $\frac{7200}{160}$=45 *acres. Ans.*

3. If a board or plank be 21 feet long, and 18 inches broad; how many square feet are contained in it?

18 *inches*=1,5 *feet*, then 21×1,5=31,5 *Ans*

Or, in measuring boards, you may multiply the length in feet by the breadth in inches, and divide by 12, the quotient will give the answer in square feet, &c.

Thus, in the foregoing example, 21×18÷12=31,5 as before.

4. If a board be 8 inches wide, how much in length will make a square foot?

Rule.—Divide 144 by the breadth, thus, 8)144

Ans. 18 *in.*

5. If a piece of land be 5 rods wide, how many rods in length will make an acre?

Rule.—Divide 160 by the breadth, and the quotient will be the length required, thus, 5)160

Ans. 32 *rods in length.*

Art. 3. To measure a Triangle.

Definition.—A Triangle is any three cornered figure which is bounded by three right lines.*

RULE.

Multiply the base of the given triangle into half its perpendicular height, or half the base into the whole perpendicular, and the product will be the area.

EXAMPLES.

1. Required the area of a triangle whose base or longest side is 32 inches, and the perpendicular height 14 inches.

32×7=224 *square inches, the Answer.*

2. There is a triangular or three cornered lot of land whose base or longest side is 51½ rods; the perpendicular from the corner opposite the base measures 44 rods; how many acres doth it contain?

51,5×22=1133 *square rods,=7 acres, 13 rods.*

**A Triangle may be either right angled or oblique; in either case the teacher can easily give the scholar a right idea of the base and perpendicular, by marking it down on a slate, paper, &c.*

TO MEASURE A CIRCLE.

Art. 4. The diameter of a Circle being given, to find the Circumference.

RULE.

As 7 : is to 22 : : so is the given diameter : to the circumference. Or, more exactly, As 113 : is to 355 : : &c. the diameter is found inversely.

Note.—The diameter is a right line drawn across the circle through its centre.

EXAMPLES.

1. What is the circumference of a wheel whose diameter is 4 feet?—As 7 : 22 : : 4 : 12,57 the circumference.

2. What is the circumference of a circle whose diameter is 35?—As 7 : 22 : : 35 : 110 *Ans.*—and inversely as 22 : 7 : : 110 : 35, the diameter, &c.

Art. 5. To find the area of a Circle.

RULE.

Multiply half the diameter by half the circumference, and the product is the area; or if the diameter is given without the circumference, multiply the square of the diameter by ,7854 and the product will be the area.

EXAMPLES.

1. Required the area of a circle whose diameter is 12 inches, and circumference 37,7 inches.

18,85=half the circumference.
6=half the diameter.

113,10 area in square inches.

2. Required the area of a circular garden whose diameter is 11 rods? ,7854
By the second method, 11×11 = 121

Ans. 95,0334 *rods.*

SECTION 2. OF SOLIDS.

Solids are estimated by the solid inch, solid foot, &c. 1728 of these inches, that is 12×12×12 make 1 cubic or solid foot.

ART. 6. To measure a Cube.

Definition.—A cube is a solid of six equal sides, each of which is an exact square.

RULE.

Multiply the side by itself, and that product by the same side, and this last product will be the solid content of the cube.

EXAMPLES.

1. The side of a cubic block being 18 inches, or 1 foot and 6 inches, how many solid inches doth it contain?

ft. in. ft.
1 6=1,5 and 1,5×1,5×1,5=3,375 *solid feet. Ans.*
Or, 18×18×18=5832 solid inches, and $\frac{5832}{1728}$=3,375.

2. Suppose a cellar to be dug that shall contain 12 feet every way, in length, breadth and depth; how many solid feet of earth must be taken out to complete the same?

12×12×12=1728 *solid feet, the Ans.*

ART. 7. To find the content of any regular solid of three dimensions, length, breadth and thickness, as a piece of timber squared, whose length is more than the breadth and depth.

RULE.

Multiply the breadth by the depth, or thickness, and that product by the length, which gives the solid content.

EXAMPLES.

1. A square piece of timber, being one foot 6 inches, or 18 inches broad, 9 inches thick, and 9 feet or 108 inches long; how many solid feet doth it contain?

1 ft. 6 in=1,5 foot.
9 inches = ,75 foot.

Prod. 1,125×9=10,125 *solid feet, the Ans.*
in. in. in. solid in.
Or, 18×9×108=17496÷1728=10,125 *feet.*

But, in measuring timber, you may multiply the breadth in inches, and the depth in inches, and that product by the length in feet, and divide the last product by 144, which will give the solid content in feet, &c.

2. A piece of timber being 16 inches broad, 11 inches thick, and 20 feet long, to find the content?

Breadth 16 inches.
Depth 11

Prod. 176×20=3520 then, 3520÷144=24,4 *feet, the Answer.*

3. A piece of timber 15 inches broad, 8 inches thick, and 25 feet long; how many solid feet doth it contain?
Ans. 20,8+*feet.*

ART. 8. When the breadth and thickness of a piece of timber are given in inches, to find how much in length will make a solid foot.

RULE.

Divide 1728 by the product of the breadth and depth, and the quotient will be the length making a solid foot.

EXAMPLES.

1. If a piece of timber be 11 inches broad and 8 inches deep, how many inches in length will make a solid foot?
11×8=88)1728(19,6 *inches, Ans.*

2. If a piece of timber be 18 inches broad and 14 inches deep, how many inches in length will make a solid foot?
18×14=252 *divisor, then* 252)1728(6,8 *inches, Ans.*

ART. 9. To measure a Cylinder.

Definition.—A Cylinder is a round body whose bases are circles, like a round column or stick of timber, of equal bigness from end to end.

RULE.

Multiply the square of the diameter of the end by ,7854 which gives the area of the base; then multiply the area of the base by the length, and the product will be the solid content.

EXAMPLE.

What is the solid content of a round stick of timber of equal bigness from end to end, whose diameter is 18 *inches,* and length 20 feet?

18 in.=1,5 ft.
×1,5

Square 2,25×,7854=1,76715 area of the base.
×20 length.

Ans. 35,34300 *solid content.*

Or, 18 inches.
18 inches.

324×,7854=254,4696 inches, area of the base.
20 length in feet.

144)5089,3920(35,343 *solid feet. Ans.*

Art. 10. To find how many solid feet a round stick of timber, equally thick from end to end, will contain when hewn square.

RULE.

Multiply twice the square of its semi-diameter in inches by the length in feet, then divide the product by 144, and the quotient will be the answer.

EXAMPLE.

If the diameter of a round stick of timber be 22 inches and its length 20 feet, how many solid feet will it contain when hewn square?

11×11×2×20÷144=33,6+ feet, the solidity when hewn square.

Art. 11. To find how many feet of square edged boards of a given thickness, can be sawn from a log of a given diameter.

RULE.

Find the solid content of the log, when made square, by the last article—Then say, As the thickness of the board including the saw calf : is to the solid feet : : so is 12 (inches) to the number of feet of boards.

EXAMPLE.

How many feet of square edged boards, 1¼ inch thick, including the saw calf, can be sawn from a log 20 feet long and 24 inches diameter?

12×12×2×20÷144=40 *feet, solid content.*

As 1¼ : 40 : : 12 : 384 feet, the Ans.

ART. 12. The length, breadth and depth of any square box being given, to find how many bushels it will contain.

RULE.

Multiply the length by the breadth, and that product by the depth, divide the last product by 2150,425 the solid inches in a statute bushel, and the quotient will be the answer.

EXAMPLE.

There is a square box, the length of its bottom is 50 inches, breadth of ditto 40 inches, and its depth is 60 inches; how many bushels of corn will it hold?

$50\times40\times60\div2150{,}425=55{,}84+$ or 55 *bushels, three pecks. Ans.*

ART. 13. The dimensions of the walls of a brick building being given, to find how many bricks are necessary to build it.

RULE.

From the whole circumference of the wall measured round on the outside, subtract four times its thickness, then multiply the remainder by the height, and that product by the thickness of the wall, gives the solid content of the whole wall; which multiplied by the number of bricks contained in a solid foot, gives the answer.

EXAMPLE.

How many bricks 8 inches long, 4 inches wide, and 2½ inches thick, will it take to build a house 44 feet long, 40 feet wide, and 20 feet high, and the walls to be one foot thick?

$8\times4\times2{,}5=80$ solid inches in a brick, then $1728\div80=21{,}6$ bricks in a solid foot.

$44+40+44+40=168$ feet, whole length of wall.
—4 four times the thickness.

164 remains.
Multiply by 20 height.

3280 solid feet in the whole wall.
Multiply by 21,6 bricks in a solid foot.

Product, 70848 bricks. Ans.

ART. 14. To find the tonnage of a ship.

RULE.

Multiply the length of the keel by the breadth of the beam, and that product by the depth of the hold, and divide the last product by 95, and that quotient by the tonnage.

EXAMPLE.

Suppose a ship 72 feet by the keel, and 24 feet by the beam, and 12 feet deep; what is the tonnage?

$72\times24\times12\div95=218,2+$ tons. *Ans.*

RULE II.

Multiply the length of the keel by the breadth of the beam, and that product by half the breadth of the beam, and divide by 95.

EXAMPLE.

A ship 84 feet by the keel, 28 feet by the beam; what is the tonnage?

$84\times28\times14\div95=350,29$ tons. *Ans.*

ART. 15. From the proof of any cable, to find the strength of another.

RULE.

The strength of cables, and consequently the weights of their anchors, are as the cube of their peripheries.

Therefore; As the cube of the periphery of any cable,
Is to the weight of its anchor;
So is the cube of the periphery of any other cable,
To the weight of its anchor.

EXAMPLES.

1. If a cable 6 inches about, require an anchor of $2\frac{1}{4}$ cwt. of what weight must an anchor be for a 12 inch cable?

As $6\times6\times6$: $2\frac{1}{4}$*cwt.* : : $12\times12\times12$: 18*cwt.* *Ans.*

2. If a 12 inch cable require an anchor of 18 cwt. what must the circumference of a cable be, for an anchor of $2\frac{1}{4}$ cwt.?

cwt.		*cwt.*	*in.*
As 18 :	$12\times12\times12$: :	2,25 :	$216\ \sqrt[3]{216}=6$ *Ans.*

ART. 16. Having the dimensions of two similar built ships of a different capacity, with the burthen of one of them, to find the burthen of the other.

RULE.

The burthens of similar built ships are to each other, as the cubes of their like dimensions.

EXAMPLE.

If a ship of 300 tons burthen be 75 feet long in the keel, I demand the burthen of another ship, whose keel is 100 feet long?

				T.	*cwt.*	*qrs.*	*lb.*
As $75\times75\times75$:	300 : :	$100\times100\times100$:		711	2	0	24+

DUODECIMALS,

OR

CROSS MULTIPLICATION,

Is a rule made use of by workmen and artificers in casting up the contents of their work.

RULE.

1. Under the multiplicand write the corresponding denominations of the multiplier.

2. Multiply each term into the multiplicand, beginning at the lowest, by the highest denomination in the multiplier, and write the result of each under its respective term; observing to carry an unit for every 12, from each lower denomination to its next superior.

3. In the same manner multiply all the multiplicand by the inches, or second denomination, in the multiplier, and set the result of each term one place removed to the right hand of those in the multiplicand.

4. Do the same with the seconds in the multiplier, setting the result of each term two places to the right hand of those in the multiplicand, &c.

EXAMPLES.

	F.	*I.*		*F.*	*I.*		*F.*	*I.*		*F.*	*I.*	
Multiply	7	3		7	5		4	6		9	7	
By	4	7		3	9	″	5	8		9	7	″
	29	0	″	27	9	9	25	6		91	10	1
	4	2	9									
Product,	33	2	9									

	F.	I.	″	F.	I.	″	F.	I.	″
Multiply	4	7		3	8		9	7	
By	5	10		7	6		3	6	
Product,	26	8	10	27	6		32	6	6

	F.	I.	″	F.	I.	″	F.	I.	″
Multiply	3	11		6	5		7	10	
By	9	5		7	6		8	11	
Product,	36	10	7	48	1	6	69	10	2

FEET, INCHES AND SECONDS.

	F.	I.	″	‴	⁗	
Multiply	9	8	6			
By	7	9	3			
	67	11	6			=prod. by the feet in the multiplier.
	7	3	4	6		=ditto by the inches.
		2	5	1	6	=ditto by the seconds.
	75	5	3	7	6	*Ans.*

	F.	I.	″	‴	⁗	F.	I.	″	‴	⁗
Multiply	7	1	9			5	6	7		
By	7	8	9			8	9	10		
Product,	55	2	9	3	9	48	11	2	8	10

How many square feet in a board 16 feet 9 inches long, and 2 feet 3 inches wide?

By Duodecimals.

	F.	I.	″
	16	9	
	2	3	
	33	6	
	4	2	3
Ans.	37	8	3

By Decimals.

F. I.
16 9=16,75 feet.
2 3= 2,25
8375
3350
3350
F. I. ″
Ans. 37,6875=37 8 3

TO MEASURE LOADS OF WOOD.

RULE.

Multiply the length by the breadth, and the product by the depth or height, which will give the content in solid feet; of which 64 make half a cord, and 128 a cord.

EXAMPLE.

How many solid feet are contained in a load of wood, 7 feet 6 inches long, 4 feet 2 inches wide, and 2 feet 3 inches high?

7 ft. 6 *in.*=7,5 *and* 4 *ft.* 2 *in.*=4,167 *and* 2 *ft.* 3 *in*= 2,25; then, 7,5×4,167=31,2525×2,25=70,318125 *solid feet*, *Ans.*

But loads of wood are commonly estimated by the foot, allowing the load to be 8 feet long, 4 feet wide, and then 2 feet high will make half a cord, which is called 4 feet of wood; but if the breadth of the load be less than 4 feet, its height must be increased so as to make half a cord, which is still called 4 feet of wood.

By measuring the breadth and heighth of the load, the content may be found by the following

RULE.

Multiply the breadth by the height, and half the product will be the content in feet and inches.

EXAMPLE.

Required the content of a load of wood which is 3 feet 9 inches wide and 2 feet 6 inches high.

	By Duodecimals.			*By Decimals.*		
	F.	*in.*		*F.*		
	3	9		3,75		
	2	6		2,5		
	7	6		1875		
	1	10	6	750		
	9	4	6	9,375		
					F.	*in.*
Ans.	4	8	3	4,6875=	4	8¼, *or half a cord and* 8¼ *inches over.*

The foregoing method is concise and easy to those who are well acquainted with Duodecimals, but the following Table will give the content of any load of wood, by inspection only, sufficiently exact for common practice; which will be found very convenient.

A TABLE of Breadth, Height, and Content.

Breadth.		*Height in feet.*				*Inches.*										
ft.	*in.*	1	2	3	4	1	2	3	4	5	6	7	8	9	10	11
2	6	15	30	45	60	1	2	4	5	6	7	9	10	11	12	14
	7	16	31	47	62	1	3	4	5	6	8	9	10	12	13	14
	8	16	32	48	64	1	3	4	5	7	8	9	11	12	13	15
	9	17	33	49	66	1	3	4	6	7	8	9	11	12	14	15
	10	17	34	51	68	2	3	4	6	7	9	10	11	13	14	16
	11	18	35	53	70	2	3	4	6	7	9	10	12	13	15	16
3	0	18	36	54	72	2	3	5	6	8	9	11	12	14	15	17
	1	19	37	56	74	2	3	5	6	8	9	11	12	14	16	17
	2	19	38	57	76	2	3	5	6	8	10	11	13	14	16	17
	3	19	39	59	78	2	3	5	7	8	10	11	13	15	16	18
	4	20	40	60	80	2	3	5	7	8	10	12	13	15	17	18
	5	21	41	62	82	2	3	5	7	8	10	12	14	16	17	19
	6	21	42	63	84	2	4	5	7	9	11	12	14	16	18	19
	7	22	43	64	86	2	4	5	7	9	11	13	14	16	18	20
	8	22	44	66	88	2	4	6	7	9	11	13	15	17	18	20
	9	23	45	68	90	2	4	6	7	9	11	13	15	17	19	21
	10	23	46	69	92	2	4	6	7	9	12	13	15	17	19	21
	11	23	47	70	94	2	4	6	8	10	12	14	16	18	20	22
4	0	24	48	72	96	2	4	6	8	10	12	14	16	18	20	22

TO USE THE FOREGOING TABLE.

First measure the breadth and height of your load to the nearest average inch; then find the breadth in the left hand column of the table; then move to the right on the same line till you come under the height in feet, and you will have the content in inches, answering the feet, to which add the content of the inches on the right and divide the sum by 12, and you will have the true content of the load in feet and inches.

NOTE.—The contents answering the inches being always small, may be added by inspection.

EXAMPLES.

1. Admit a load of wood is 3 feet 4 inches wide, and 2 feet 10 inches high; required the content.—

Thus, against 3 ft. 4 inches, and under 2 feet, stands 40 inches; and under 10 inches at top, stands 17 inches: then 40+17=57 true content in inches, which divide by 12 gives 4 feet 9 inches, the answer.

2. The breadth being 3 feet, and height 2 feet 8 inches; required the content.—

Thus, with breadth feet 0 inches and under 2 feet atop, stands 36 inches; and under 8 inches, stands 12 inches: now 36 and 12, make 48, the answer in inches; and 48÷12=4 feet, or just half a cord.

3. Admit the breadth to be 3 feet 11 inches, and height 3 feet 9 inches; required the content.

Under 3 feet at top, stands 70; and under 9 inches, is 18: 70 and 18, make 88÷12=7 feet 4 inches, or 7 ft. 1 qr. 2 inches, the answer.

TABLE I.

Showing the amount of £1, or $1, at 5 and 6 per cent. per annum, Compound Interest, for 20 years.

Yrs.	*5 per cent.*	*6 per cent.*	*Yrs.*	*5 per cent.*	*6 per cent.*
1	1,05000	1,06000	11	1,71034	1,89829
2	1,10250	1,12360	12	1,79585	2,01219
3	1,15762	1,19101	13	1,88565	2,13292
4	1,21550	1,26247	14	1,97993	2,26090
5	1,27628	1,33822	15	2,07893	2,39655
6	1,34009	1,41851	16	2,18287	2,54727
7	1,40710	1,50363	17	2,29201	2,69277
8	1,47745	1,59384	18	2,40661	2,85433
9	1,55132	1,68947	19	2,52695	3,02559
10	1,62889	1,79084	20	2,65329	3,20713

VII. *The weights of the coins of the United States.*

	pwt.	*gr.*	
Eagles,	11	6	Standard Gold.
Half-Eagles,	5	15	
Quarter-Eagles,	2	19½	
Dollars,	17	8	Standard Silver.
Half-Dollars,	8	16	
Quarter-Dollars,	4	8	
Dimes,	1	17⅗	
Half-Dimes,		20⅘	
Cents,	8	16	Copper.
Half-Cents,	4	8	

The standard for gold coin is 11 parts pure gold, and one part alloy— the alloy to consist of silver and copper. The standard for silver coin is 1485 parts fine to 179 parts alloy—the alloy to be wholly copper.

ANNUITIES.

	TABLE II. Showing the amount of £1 annuity, forborne for 31 years or under, at 5 and 6 per cent. compound interest.		TABLE III. Showing the present worth of £1 annuity, to continue for 31 years, at 5 and 6 per cent. compound int.	
Yrs.	5	6	5	6
1	1,000000	1,000000	0,952381	0,943396
2	2,050000	2,060000	1,859410	1,833393
3	3,152500	3,183600	2,723248	2,673012
4	4,310125	4,374616	3,545950	3,465106
5	5,525631	5,637193	4,329477	4,212364
6	6,801913	6,975319	5,075692	4,917324
7	8,142009	8,393838	5,786278	5,582381
8	9,549109	9,897468	6,463213	6,209794
9	11,026564	11,491316	7,107822	6,801692
10	12,577892	13,180770	7,721735	7,360087
11	14,206787	14,971643	8,306414	7,886875
12	15,917126	16,869942	8,863252	8,383844
13	17,712982	18,882138	9,393573	8,852683
14	19,598632	21,015066	9,898641	9,294984
15	21,578564	23,275969	10,379658	9,712249
16	23,657492	25,672528	10,837769	10,105895
17	25,840366	28,212380	11,274066	10,477260
18	28,132385	30,905653	11,689587	10,827603
19	30,539004	33,759992	12,085321	11,158116
20	33,065954	36,785592	12,462210	11,469921
21	35,719252	39,992727	12,821153	11,764077
22	38,505214	43,392291	13,163003	12,041582
23	41,430475	46,995828	13,488574	12,303380
24	44,501999	50,815578	13,798642	12,550357
25	47,727099	54,864512	14,093944	12,783356
26	51,113454	59,156382	14,375185	13,003166
27	54,669126	63,705765	14,643034	13,210534
28	58,402583	68,528112	14,898127	13,406164
29	62,322712	73,639798	15,141073	13,590721
30	66,438847	79,058186	15,372451	13,764831
31	70,760790	84,801677	15,592810	13,929086

TABLES.

THE three following Tables are calculated agreeable to an Act of Congress passed in November, 1792, making foreign Gold and Silver Coins a legal tender for the payment of all debts and demands, at the several and respective rates following, viz. The Gold Coins of Great-Britain and Portugal, of their present standard, at the rate of 100 cents for every 27 grains of the actual weight thereof.—Those of France and Spain 27⅔ grains of the actual weight thereof.—Spanish milled Dollars weighing 17 pwt. 7 gr. equal to 100 cents, and in proportion for the parts of a dollar.—Crowns of France, weighing 18 pwt. 17 gr. equal to 110 cents, and in proportion for the parts of a Crown.—They have enacted, that every cent shall contain 208 grains of copper, and every half-cent 104 grains.

TABLE IV.

Weights of several pieces of English, Portuguese, and French Gold Coins.

	Pwt.	*Gr.*	*Dols.*	*Cts.*	*M.*
Johannes, ...	18		16	0	0
Single, ditto, ...	9		8		
English Guinea, ...	5	6	4	66⅔	
Half, ditto, ...	2	15	2	33⅓	
French Guinea, ...	5	6	4	59	8
Half, ditto, ...	2	15	2	29	9
4 Pistoles, ...	16	12	14	45	2
2 Pistoles, ...	8	6	7	22	6
1 Pistole, ...	4	3	3	61	3
Moidore, ...	6	22	6	14	8

TABLE V.

Weights of English and Portuguese Gold, in Dollars, Cents and Mills.

Grs.	Cts.	Mills.	Pwts.	Dols.	Cts.	Mills.
1	3	7	1	0	89	
2	7	4	2	1	77	7
3	11	1	3	2	66	6
4	14	8	4	3	55	5
5	18	5	5	4	44	4
6	22	2	6	5	33	3
7	25	9	7	6	22	2
8	29	6	8	7	11	1
9	33	3	9	8		
10	37		10	8	89	
11	40	7	11	9	77	7
12	44	4	12	10	66	6
13	48	1	13	11	55	5
14	51	8	14	12	44	4
15	55	5	15	13	33	3
16	59	2	16	14	22	2
17	63		17	15	11	1
18	66	6	18	16		
19	70	4	19	16	89	
20	74	1	oz			
21	77	2	1	17	77	
22	81	5	2	35	55	5
23	85	2	3	53	33	5

TABLE VI.

Weights of French and Spanish Gold, in Dollars, Cents and Mills.

Grs.	Cts.	Mills.	Pwts.	Dols.	Cts.	Mills.
1	3	6	1	0	87	6
2	7	3	2	1	75	2
3	11		3	2	62	7
4	14	6	4	3	50	3
5	18	2	5	4	38	
6	21	9	6	5	25	5
7	25	5	7	6	13	1
8	29	2	8	7	00	7
9	32	8	9	7	88	3
10	36	5	10	8	76	
11	40	1	11	9	63	5
12	43	8	12	10	51	1
13	47	4	13	11	38	7
14	51	1	14	12	26	3
15	54	6	15	13	13	9
16	58	4	16	14	1	5
17	62	0	17	14	89	0
18	65	7	18	15	76	6
19	69	3	19	16	64	2
20	73		oz			
21	76	6	1	17	51	8
22	80	3	2	35	3	6
23	83	9	3	52	55	5

VIII. *TABLE of Cents, answering to the Currencies of the United States, with Sterling, &c.*

NOTE.—The figures on the right hand of the space, show the parts of a cent, or mills, &c.

	6s. to the Doll.		*8s. to the Doll.*		*7s.6d. to the Doll.*		*4s.8d. to the Doll.*		*5s. to the Doll.*		*4s.6d. to the Doll.*		*4s. 10½d. to the Dollar.*	
P.	*cents.*		*cents.*		*cents.*		*cents.*		*cents.*		*cents.*		*cents.*	
1	1	3	1	0	1	1	1	7	1	6	1	8	1	7
2	2	7	2	0	2	2	3	5	3	3	3	7	3	4
3	4	1	3	1	3	3	5	3	5		5	5	5	1
4	5	5	4	1	4	4	7	1	6	3	7	4	6	8
5	6	9	5	2	5	5	8	9	8	6	9	2	8	5
6	8	3	6	2	6	6	10	7	10		11	1	10	2
7	9	7	7	2	7	7	12	5	11	6	12	9	11	9
8	11	1	8	3	8	8	14	2	13	3	14	8	13	6
9	12	5	9	3	10		16		15		16	6	15	3
10	13	8	10	4	11	1	17	8	16	6	18	5	17	
11	15	2	11	4	12	2	19	6	18	3	20	3	18	
S.														
1	16	6	12	5	13	3	21	4	20		22	2	20	
2	33	3	25		26	6	42	8	40		44	4	41	
3	50		37	5	40		64	2	60		66	6	61	5
4	66	6	50		53	3	85	7	80		88	8	82	
5	83	3	62	5	66	6	107	1	100		111	1	102	5
6	100		75		80		128	5	120		133	3	123	
7	116	6	87	5	93	3	150		140		155	5	143	5
8	133	3	100		106	6	171	4	160		177	7	164	1
9	150		112	5	120		192	8	180		200		184	6
10	166	6	125		133	3	214	2	200		222	2	205	1
11	183	3	137	5	146	6	235	7	220		244	4	225	6
12	200		150		160		257	1	240		266	6	246	1
13	216	6	162	5	173	3	278	5	260		288	8	266	6
14	233	3	175		186	6	300		280		311	1	287	1
15	250		187	5	200		321	4	300		333	3	307	6
16	266	6	200		213	3	342	8	320		355	5	328	2
17	283	3	212	5	226	6	364	2	340		377	7	348	7
18	300		225		240		385	6	360		400		369	2
19	316	6	237	5	253	3	407	1	380		422	2	389	7
20	333	3	250		266	6	428	5	400		444	4	410	2

TABLE IX.

Showing the value of Federal Money in other Currencies.

Federal Money.	*New-England, Virginia, and Kentucky currency.*		*New-York and North-Carolina currency.*		*N. Jersey, Pennsylvania, Delaware, and Maryland currency.*		*South-Carolina, and Georgia currency.*	
Cents.	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
1	0	0¾	0	1	0	1	0	0½
2	0	1½	0	2	0	1¾	0	1
3	0	2¼	0	3	0	2¾	0	1¾
4	0	3	0	3¾	0	3½	0	2¼
5	0	3½	0	4¾	0	4½	0	2¾
6	0	4½	0	5¾	0	5½	0	3¼
7	0	5	0	6¾	0	6¼	0	4
8	0	5¾	0	7¾	0	7¼	0	4½
9	0	6½	0	8¾	0	8	0	5
10	0	7¼	0	9½	0	9	0	5½
11	0	8	0	10½	0	10	0	6¼
12	0	8¾	0	11½	0	10¾	0	6¾
13	0	9¼	1	0½	0	11¾	0	7¼
14	0	10	1	1½	1	0½	0	7¾
15	0	10¾	1	2½	1	1½	0	8½
16	0	11½	1	3¼	1	2½	0	9
17	1	0¼	1	4¼	1	3¼	0	9½
18	1	1	1	5¼	1	4¼	0	10
19	1	1¾	1	6¼	1	5¼	0	10¾
20	1	2½	1	7¼	1	6	0	11¼
30	1	9½	2	4¾	2	3	1	4¾
40	2	4¾	3	2½	3	0	1	10½
50	3	0	4	0	3	9	2	4
60	3	7¼	4	9½	4	6	2	9½
70	4	2½	5	7¼	5	3	3	3¼
80	4	9½	6	4¾	6	0	3	8¾
90	5	4¾	7	2½	6	9	4	2½
100	6	0	8	0	7	6	4	8

A FEW USEFUL FORMS IN TRANSACTING BUSINESS.

AN OBLIGATORY BOND.

KNOW all men by these presents, that I, C. D. of in the county of am held and firmly bound to H. W. of in the penal sum of to be paid H. W. his certain attorney, executors and administrators; to which payment, well and truly to be made and done, I bind myself, my heirs, executors and administrators, firmly by these presents. Signed with my hand, and sealed with my seal. Dated at this day of A. D.

The condition of this obligation is such, That if the above bounden C. D. &c. [*Here insert the condition.*] Then this obligation to be void and of none effect; otherwise to remain in full force and virtue.

Signed, sealed and delivered
in the presence of

A BILL OF SALE.

KNOW all men by these presents, that I, B. A. of for and in consideration of to me in hand paid by D. C. of the receipt whereof I do hereby acknowledge, have bargained, sold and delivered, and, by these presents, do bargain, sell and deliver unto the said D. C. [*Here specify the property sold.*] To HAVE and to HOLD the aforesaid bargained premises, unto the said D. C. his executors, administrators and assigns, forever. And I, the said B. A. for myself, my executors and administrators, shall and will warrant and defend the same against all persons, unto the said D. C. his executors, administrators and assigns, by these presents. In witness whereof, I have hereunto set my hand and seal, this day of 1814.

In presence of

A SHORT WILL.

I, B. A. of, &c. do make and ordain this my last will and testament, in manner and form following, viz. I give and bequeath to my dear brother, R. A. the sum of ten pounds, to buy him mourning. I give and bequeath to my son, J. A. the sum of two hundred pounds. I give and bequeath to my daughter, E. E. the sum of one hundred pounds; and to my daughter A. V. the like sum of one hundred pounds. All the rest and residue of my estate, goods and chattels, I give and bequeath to my dear beloved wife, E. R. whom I nominate, constitute and appoint sole executrix of this my last will and testament, hereby revoking all other and former wills by me at any time heretofore made. In witness whereof, I have hereunto set my hand and seal, the day of in the year of our Lord

Signed, sealed, published and declared by the said testator, B. A. as and for his last will and testament, in the presence of us who have subscribed our names as witnesses thereto, in the presence of the said testator.

R. A.
S. D.
L. T.

Note.—The testator after taking off his seal, must in presence of the witnesses pronounce these words, "I publish and declare this to be my last will and testament."

Where real estate is devised, three witnesses are absolutely necessary, who must sign it in the presence of the testator.

A LEASE OF A HOUSE.

KNOW all men by these presents, that I, A. B. of in for and in consideration of the sum of received to my full satisfaction of P. V. of this day of in the year of our Lord, have demised and to farm let, and do by these presents, demise and to farm let, unto the said P. V. his heirs, executors, administrators and assigns, one certain piece of land, lying and being situated in said bounded, &c. [Here describe the boundaries] with a dwelling-house thereon standing, for the term of one year from this date. To have and to hold to him the said P. V. his heirs, executors, administrators and assigns for said term, to him the said P. V. to use and occupy, as to him shall seem meet and proper. And the said A. B. doth FURTHER COVENANT with the said P. that he hath good right to let and demise, the said letten and demised premises in manner aforesaid, and that he the said A. during the said time will suffer the said P. quietly to HAVE and to HOLD, use, occupy and enjoy said demised premises, and that said P. shall have, hold, use, occupy, possess and enjoy the same, free and clear of all incumbrances, claims, rights and titles whatsoever. In witness whereof, I the said A. B. have hereunto set my hand and seal this day of

Signed, sealed and delivered }
In presence of } A. B.

A NOTE PAYABLE AT A BANK.

$500, 60 HARTFORD, May 30, *1815*.

FOR value received, I promise to pay to John Merchant, or order, Five Hundred Dollars and Sixty Cents, at Hartford Bank, in sixty days from the date.

WILLIAM DISCOUNT.

AN INLAND BILL OF EXCHANGE.

$83, 34 BOSTON, June 1, 1815.

TWENTY days after date, please to pay to S. C or order, Eighty-Three Dollars and Thirty-Four Cents and place it to my account, as per advice from your humble servant, T. P.

Mr. T. W. Merchant, }
New-York. }

A PROMISSORY NOTE.

$130 NEW-YORK, March 8, 1814.

FOR value received, I promise to pay to H. W. One Hundred and Thirty Dollars, in four months from this date, with interest until paid. J. S.

FINIS.

Hunt